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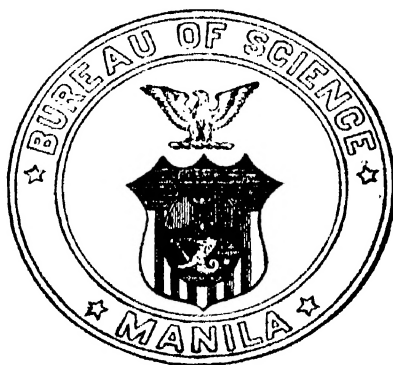
SECTION D GENERAL BIOLOGY, ETHNOLOGY, AND ANTHROPOLOGY

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R. C. MCGREGOR, A. B.; R. P. COWLES, PH. D.; C. F. BAKER, A. M.
S. F. LIGHT, M. A.; C. S. BANKS, M. S.; L. D. WHARTON, M. A.
W. SCHULTZE; H. O. BEYER, M. A.; H. E. KUPFER, A. B.

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THE PHILIPPINE JOURNAL OF SCIENCE

D. GENERAL BIOLOGY, ETHNOLOGY,
AND ANTHROPOLOGY

VOL. XIII

JANUARY, 1918

No. 1

NEW OR NOTEWORTHY PHILIPPINE BIRDS, II

By RICHARD C. MCGREGOR

(From the Section of Ornithology and Taxidermy, Biological Laboratory,
Bureau of Science, Manila)

THREE PLATES AND TEN TEXT FIGURES

This paper includes a record of the monkey-eating eagle from a new locality in Luzon, comments on several species of terns and shore birds, and notes on some other Philippine species of more or less interest.

Megapodius cumingi Dillwyn.

The tabon is so seldom seen in Luzon that the fact of its breeding in Tayabas Province, as verified by the egg that was received with the following letter, seems worthy of publication:

GUMACA, TAYABAS, Mar. 25, 1911.

While working in the woods about six miles from Gumaca yesterday a native called my attention to a small hole in the ground in which he said a bird had a nest, and after digging about five feet I came upon four eggs, one of which I am mailing you under separate cover.

The eggs were laid on a mass of rotting wood and mold and all around the hole was the same thing. I presume the heat generated by the decaying stuff is the means of hatching the eggs. * * *

JOHN W. WILLEY,
Constructing Lineman,
Bureau of Posts.

Leucotreron merrilli McGregor. Plate I.

Leucotreron merrilli MCGREGOR, Phil. Journ. Sci., Sec. D (1916),
11, 269, fig. 1.

After I had written the description of Merrill's fruit pigeon, Mr. E. E. Schneider told me of a living pigeon in his possession

that he had been unable to identify. Upon calling at his house, I was surprised to find that Mrs. Schneider had a specimen of *Leucotreron merrilli*. This bird was secured at Albay, Luzon, where cage birds of this species are sold to people on passing steamers. The birds are doubtless snared in the vicinity of Albay. Mrs. Schneider kindly allowed us to photograph this bird and to make color notes of the unfeathered areas, which were used by the artist in the colored drawing (Plate I) that is reproduced with this paper.

This species and the closely related *Ptilopus marchei* seem to form a distinct section, or subgenus, of *Leucotreron*, distinguished especially by the decomposed and lengthened barbs on the secondaries. I propose that this subgenus be called *Neoleucotreron*, with *Leucotreron merrilli* McGregor as its type.

TABLE I.—Measurements of *Leucotreron merrilli*.

Bureau of Science No.	Locality.	Date.	Sex.	Wing.	Tail.	Ex-posed cul-men.	Tarsus.	Middle toe with claw.
				mm.	mm.	mm.	mm.	mm.
7633	Paete, Laguna.....	June 12, 1915	♂	165	125	15	28	89
7635	.....do.....	June 14, 1915	♂	161	130	18	21	58
7634	.....do.....	.....do.....	♀	155	115	17	23	37
7648	.....do.....	June 27, 1915	♀	161	120	14	21	37
7172	Polillo Island.....	Oct. 19, 1909	♀	161	119	17	24	36

* Type specimen.

Hydrochelidon leucoptera Temminck.

A small, immature female tern from Palawan has been identified by Dr. C. W. Richmond as *Hydrochelidon leucoptera*. This specimen (No. 7248) was collected on September 19, 1910, in Ulugan Bay, south of Malampaya Sound, on the west coast of Palawan Island. Although this species has a very wide range both north and south, the only previous Philippine records refer to Mindanao.

From time to time I have recorded several species of terns from the Philippine Islands, the specimens of which I had identified by means of descriptions only. As many of these records as well as those of several species of other water birds are important, I have sent the specimens to Washington, D. C., for verification of my identifications. Dr. Charles W. Richmond, assistant curator of birds, United States National Museum, has kindly given me his opinion as to the correct names of these

specimens. Several records are republished here in order fully to authenticate them.

***Sterna hirundo* Linnæus.**

Sterna fluviatilis MCGREGOR, Bull. Phil. Mus. (1904), No. 4, 12 (Calayan); MCGREGOR and WORCESTER, Hand List (1906), 20.

Sterna hirundo MCGREGOR, Man. Phil. Bds. (1909), 89.

On October 21, 1903, I killed a subadult male example (No. 3685) of the common tern from a pair flying near the beach in Calayan Island, north of Luzon. I recorded this specimen as *Sterna fluviatilis*. Dr. C. W. Richmond has marked "hirundo" on the tag, which is the preferred name for this species. No other tern was seen on Calayan, nor has this species come into the Bureau of Science collection again.

***Sterna gracilis* Gould.**

Sterna gracilis GOULD, Proc. Zool. Soc. London (1845), 76 (the Houtmann's Abrolhos, off the western coast of Australia); Ann. & Mag. Nat. Hist. (1845), I, 16, 346 (reprint of the above); Proc. Zool. Soc. London (1847), 222 (the same species described again!); Ann. & Mag. Nat. Hist. (1848), II, 2, 282 (reprint of the last description); SHARPE, Hand-List (1899), 1, 185.

Sterna dougalli SAUNDERS, Cat. Bds. Brit. Mus. (1896), 25, 70 (description, including *gracilis*).

A pair of terns (No. 13156, male, and No. 13157, female) collected by Messrs. D. C. Worcester and A. Celestino on July 13, 1910, on a sand bar in Green Island Bay, Palawan Island, was doubtfully marked *dougalli* by me. Dr. C. W. Richmond has examined the male specimen and pronounces it *gracilis*. Australian ornithologists use Gould's much-published name, either specifically or subspecifically, and the English name graceful tern for this Oriental form of *Sterna dougalli*. The type locality of Gould's species is the Houtmann's Abrolhos, off the western coast of Australia. Saunders says of *Sterna dougalli*, with which he units *S. gracilis*: "This is essentially a Sea-Tern, usually depositing its eggs on low islands, though sometimes, on sandy coasts."

***Sterna anætheta* Scopoli.**

Sterna anæthetus SCOPOLI, Del. Flor. et Faun. Insubr. (1786), 2, 92 (Panay Island).

Melanosterna anætheta BLYTH, Journ. As. Soc. Bengal (1846), 15, 373; cf. MATHEWS, Bds. Australia (1912), 2, pt. 4, 395; OBERHOLSER, Auk (1917), 34, 199 (question of genus).

Sterna anætheta WORCESTER, Phil. Journ. Sci., Sec. A (1907), 2, 275 (Didicas Rocks); MCGREGOR, Man. Phil. Bds. (1909), 91.

Sterna anætheta, A. O. U. Check-List, 3d ed. (1910), 46.

Worcester recorded the bridled tern from Didikas Rocks, north of Luzon. My identification of a female tern (No. 6523) killed by Mr. Worcester at the above locality has been confirmed by Dr. C. W. Richmond.

***Sterna fuscata* Linnæus.**

Sterna fuliginosa WORCESTER and BOURNS, Proc. U. S. Nat. Mus. (1898), 20, 552 (Siquijor, in distribution list); MCGREGOR and WORCESTER, Bur. Govt. Laboratories (1906), No. 36, 21; WORCESTER, Phil. Journ. Sci., Sec. D (1911), 6, 171, Pl. IV (Maeander Reef).
Sterna fuscata MCGREGOR, Man. Phil. Bds. (1909), 92.

Onychoprion fuscatus (LINNÆUS), cf. MATHEWS, Bds. Australia (1912), 2, pt. 4, 388; OBERHOLSER, Auk (1917), 34, 199 (question of genus).

A male specimen (No. 7263) of the sooty tern from a series collected by Worcester, McGregor, and Celestino on Maeander Reef, Sulu Sea, on September 22, 1910, has been examined by Dr. C. W. Richmond.

***Sterna sinensis* Gmelin.**

Sterna sinensis MCGREGOR, Man. Phil. Bds. (1909), 92, 727 (Polillo); Phil. Journ. Sci., Sec. D (1910), 5, 106.

I collected four specimens of this little tern on Polillo Island on September 7, 1909, and one of these (No. 6959) has been examined by Dr. C. W. Richmond. Dr. and Mrs. H. C. Curl collected a male (No. 12933) of this species in Cavite Province, Luzon, on October 10, 1909. Another specimen of a male (No. 13191) was secured by A. Celestino at Obando, Bulacan Province, Luzon, on October 10, 1915.

***Sterna melanauchen* Temminck.**

Sterna melanauchen MCGREGOR, Bur. Govt. Laboratories (1905), No. 25, 10 (Cresta de Gallo); Man. Phil. Bds. (1909), 93.

Messrs. D. C. Worcester and A. Celestino collected a dozen specimens of *Sterna melanauchen* on July 13, 1910, in Green Island Bay, Palawan Island, where birds of this species were nesting on a small sand bar. One of these specimens (No. 13164) and the one (No. 4502, male) recorded by me from Cresta de Gallo Island, near Sibuyan, have been examined by Dr. C. W. Richmond.

***Ochthodromus veredus* (Gould).**

Ochthodromus veredus MCGREGOR, Man. Phil. Bds. (1909), 108 (Palawan), 727 (Luzon).

The Eastern dotterel is the rarest of the three Philippine plovers that are commonly placed in the genus *Ochthodromus*.

The other two are abundant and have been found on many of the islands. The Bureau of Science possesses only three specimens of *O. veredus*. Two (No. 13176, male, and No. 13177) were collected by Col. John R. White at Iwahig, Palawan, on July 15, 1908. One of these is a male in summer plumage. The dark chestnut band and the blackish band on the throat and the chest are well developed. The toes and half of the tarsus are missing from the right leg of the specimen, and the collector's tag bears the note: "Shot on plaza. One leg missing when killed." The other specimen, of which the sex is not given, has the bands

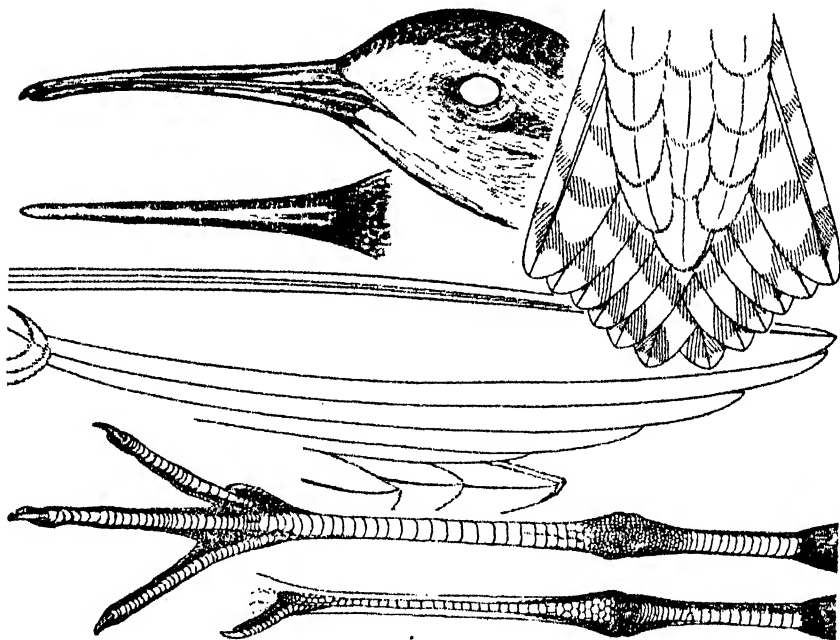


FIG. 1. *Mesoscolopax minutus* (Gould). Actual size.

on the lower throat and the chest pale brown. A female (No. 12981) in immature plumage was collected by Dr. and Mrs. H. C. Curl at Cañacao, Cavite, Luzon, on September 11, 1909.

***Mesoscolopax minutus* (Gould). Fig. 1.**

Mesoscolopax minutus MCGREGOR, Man. Phil. Bds. (1909), 119, 727 (Luzon).

My record of the pygmy curlew for Luzon was based on a female specimen (No. 12932) collected by Dr. and Mrs. H. C. Curl at Cañacao, Cavite Province, Luzon, on October 3, 1909. The specimen was presented to the Bureau of Science.

Macrorhamphus semipalmatus (Jerdon). Fig. 2.

Macrorhamphus semipalmatus RIDGWAY, Man. N. A. Bds. (1887), 151; BLANFORD, Fauna Brit. India, Bds. (1898), 4, 257.

Macrorhamphus taczanowskii SHARPE, Hand-List (1899), 1, 159; WILLIAMSON, Journ. Nat. Hist. Soc. Siam (1916), 2, 62 (Siam, September 1).

A female Oriental dowitcher was collected at Obando, Bulacan Province, Luzon, on October 21, 1912. Measurements of this specimen (No. 13280) are as follows: Wing, 169 milli-

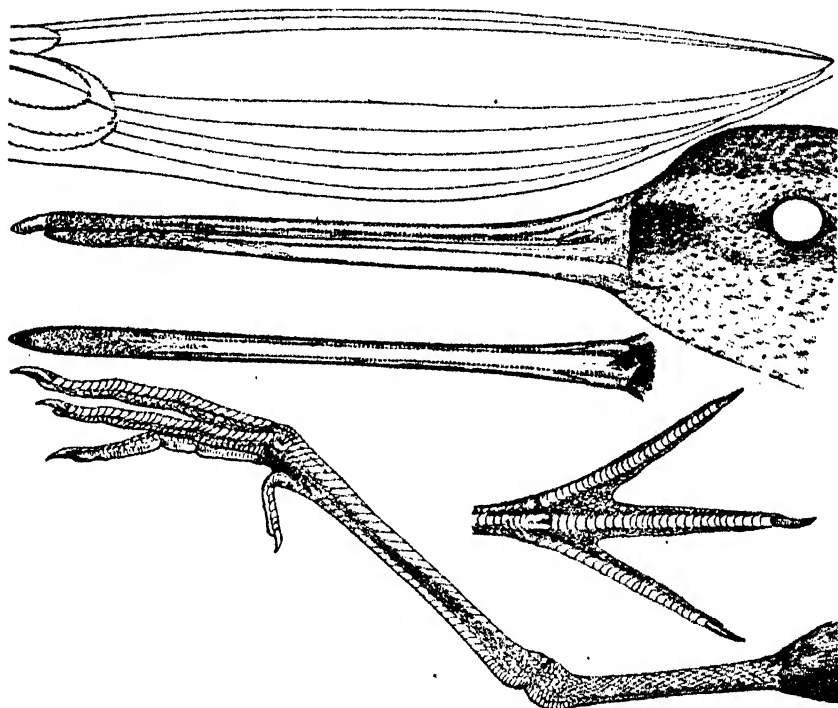


FIG. 2. *Macrorhamphus semipalmatus* (Jerdon). Actual size.

meters; tail, 65; culmen, 84; tarsus, 47; middle toe with claw, 37.

Concerning this species Blanford says:

Distribution. This rare bird breeds somewhere in Siberia, its breeding-haunts being, however, unknown, and a very few individuals have been obtained in Mongolia, China, and Japan. [Blanford here cites the following records: One from Madras, four from Calcutta, two from Pegu, one from Rangoon, and one from Raipur.]

Habits &c. Not known, but the bird is doubtless a feeder on worms or small crustacea burrowing in the mud. So far as known no Indian specimen, except perhaps Jerdon's, has been obtained on the sea-coast.

This genus is somewhat anomalous in characters. The structure of the bill is exactly as in *Gallinago*, but the length of the bill is as great as in *Philohela minor*. The other characters are those of a large, semipalmated sandpiper. Attempts to express these facts have resulted in *Macrorhamphus* being placed in different positions by different authors. Sharpe and other English writers place *Macrorhamphus* after *Limosa* in the Totininae and let *Gallinago*, etc., end the list of the Scolopacinae. The American Ornithologists' Union¹ list begins the Scolopacidae with *Scolopax*, *Philohela*, *Gallinago*, and *Macrorhamphus*; places *Limosa* after *Calidris*; and recognizes no subfamilies in the family of snipes, sandpipers, etc. Ridgway² recognizes three subfamilies in this group: Scolopacinae, the snipes; Tringinae, the sandpipers, with *Macrorhamphus* near the end next to *Limosa*; and Numeninae, the curlews.

The American species of *Macrorhamphus* are called dowitchers. Ridgway includes a diagnosis of the Oriental species of *Macrorhamphus* and uses as an English name semipalmated snipe. If there is no objection to "dowitcher" as a name, I suggest "Oriental dowitcher" for *Macrorhamphus semipalmatus* as being more appropriate than Ridgway's name, semipalmated snipe.

Of the name dowitcher Webster's Dictionary says:

Of Amer. Ind. origin; cf. Mohawk and Cayuga *ta-wis*, Onondaga, *ta-wish*, the name for the snipe.

The Standard Dictionary and the Century Dictionary give a very different derivation of the name. The latter says that dowitcher is a corruption of *deutscher*, a German, and is—

a popular and now a book name of this species [*Macrorhamphus griseus*], which was formerly locally (Long Island and vicinity) called German or Dutch snipe, to distinguish it from the so-called *English snipe*, *Gallinago wilsoni*.

Trumbull³ says of the same species:

These names Dowitch and Dowitcher meant originally that this was the Dutch or German, Snipe (*Dutch*, *Deutscher*), and were probably employed to distinguish No. 45 [*M. griseus*] particularly from the "English" snipe, No. 44.

¹ Check-list of North American Birds, 3d ed. revised. New York (1910), 109-125.

² Ridgway, R., A Manual of North American Birds. J. B. Lippincott Company, Philadelphia (1887), 147-149.

³ Trumbull, Gurdon, Names and Portraits of Birds. Harper and Brothers, New York (1888), 160-162.

I do not find that dowitcher is given by Newton ⁴ or by Murray.⁵ Snipe-billed sandpiper ⁶ and snipe-billed godwit seem to me undesirable. Red-breasted snipe, gray snipe, brown snipe, New York godwit, long-billed snipe, red-bellied snipe, and some other less-used names are inappropriate and not distinctive.⁷

Totanus stagnatilis Bechstein. Fig. 3.

Totanus stagnatilis MCGREGOR, Phil. Journ. Sci., Sec. D (1916), 11, 274 (Luzon).

Since reporting the occurrence of *Totanus stagnatilis* in Luzon, I have found three more specimens in the Bureau of Science collection, which were killed at Obando, Bulacan Province, Lu-

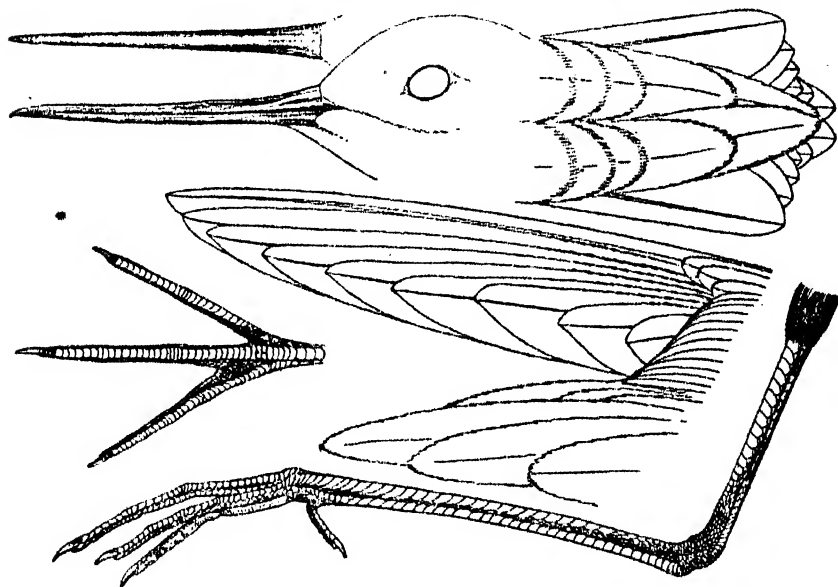


FIG. 3. *Totanus stagnatilis* Bechstein, generic details, from a male. Actual size.

zon, on November 15, 1910. In 1916 Celestino collected a male on November 29 and a female on December 27 in the same locality.

Gallinago stenura (Bonaparte). Fig. 4, b.

During the time that Dr. H. C. Curl was stationed at Cafia-

⁴ Newton, Alfred, A Dictionary of Birds. Adam and Charles Black, London (1898).

⁵ Murray, Sir James, A New English Dictionary. Oxford (1897), 3.

⁶ Seebohm, H., The Birds of the Japanese Empire. R. H. Porter, London (1890), 380. Blanford, W. T., The Fauna of British India, including Ceylon and Burma. Birds. Taylor and Francis, London (1898), 4, 257.

⁷ Trumbull, op. cit.

cao, he and Mrs. Curl spent many days in hunting snipe in the vicinity of Cavite, and Doctor Curl was much interested in the differences by which the three species found in the Philippine Islands could be distinguished. He suggested to me that there might be some average differences in their weights, and I believe that he kept a record of the weights of many specimens; but I do not think he ever published anything on the subject. A male specimen of *Gallinago stenura* collected at Cavite on September 29, 1910, by Doctor Curl has a weight of 110 grams marked on the tag. Doctor Curl kindly prepared spread tails of the three Philippine species for my use. I had intended to photograph these, but the drawings of them (figs. 4 and 5) show the differences more clearly than a photograph would.

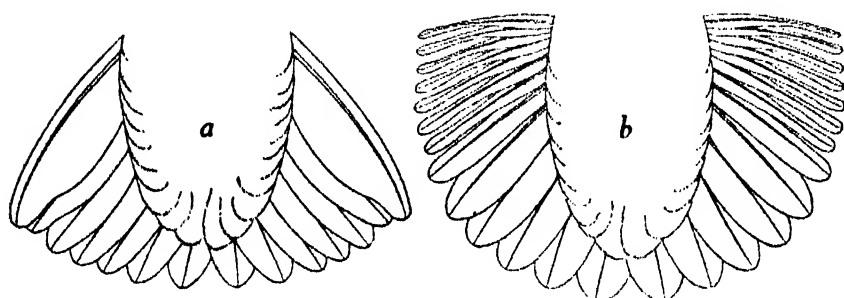


FIG. 4. a, *Gallinago gallinago* (Linnaeus), and b, *G. stenura* (Bonaparte), showing the difference in the rectrices. Two-thirds actual size.

Gallinago megala Swinhoe. Plate III, fig. 3; text fig. 5.

Messrs. Squires-Bingham Co., of Manila, sent to the Bureau of Science a partially albino male Swinhoe's snipe to be mounted. This specimen was received on September 27, 1917. The white feathers can be indicated in tabular form as follows:

TABLE II.—White feathers in wings of a specimen of *Gallinago megala*.

	Wing.	
	Left.	Right.
Primaries.....	First to seventh.....	Fourth to tenth.
Secondaries.....	First to fifth.....	First and second.
Primary coverts.....		First to fourth; sixth to tenth.
Greater coverts.....	First to sixth.....	Third to fourth.
Median coverts.....	A few.....	A few.
Lesser coverts.....	None.....	Do.
Alula.....	Second.....	Second and third.

The toes of this specimen were somewhat unusual in color as follows: Soles of toes buff-yellow; tarsi and proximal joints of

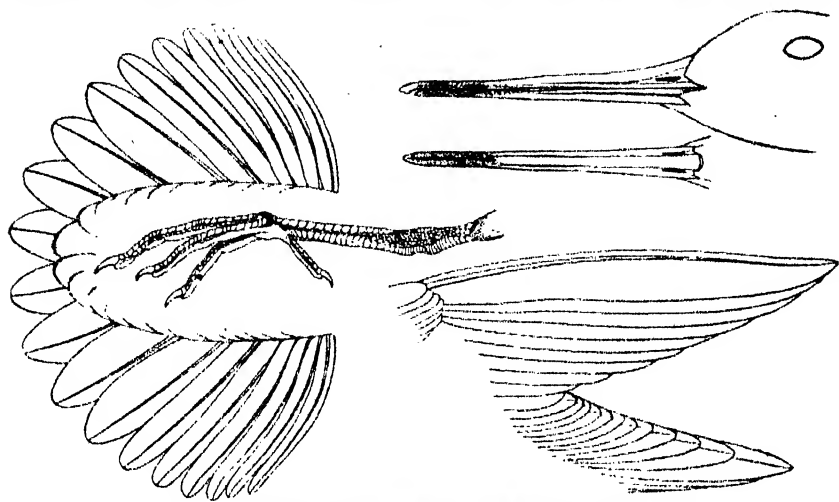


FIG. 5. *Gallinago megala* Swinhoe. Two-thirds actual size.

some toes chamois yellow; nail of hind toe on left foot black; all the other nails and some of the distal joints of all toes mustard yellow.

Lobipes lobatus (Linnæus). Fig. 6.

Lobipes lobatus MCGREGOR, Man. Phil. Bds. (1909), 149 (record of specimen collected by Mearns in Basilan Straits), 728 (Luzon).

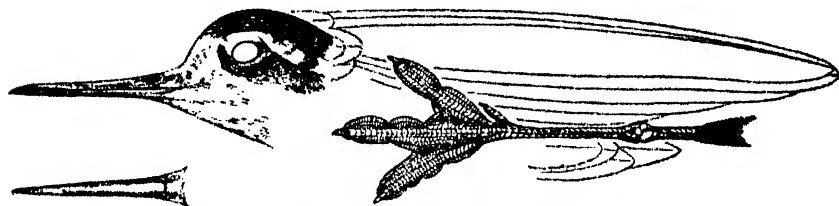


FIG. 6. *Lobipes lobatus* (Linnæus). Actual size.

A female northern phalarope in summer plumage was collected in Basilan Straits by the late E. A. Mearns on April 19, 1906 (U. S. N. M. No. 200775, B. S. No. 12901). Dr. and Mrs. H. C. Curl collected a specimen (B. S. No. 12934) of this species near Cavite, Luzon, on October 20, 1909. This specimen is in winter plumage.

Plegadis autumnalis (Linnæus). Fig. 7.

Plegadis falcinellus SHARPE, Cat. Bds. Brit. Mus. (1898), 26, 29; BLANFORD, Fauna Brit. India, Bds. (1898), 4, 364; MEARNs, Proc. Biol. Soc. Washington (1905), 18, 89 (Mindanao).

Plegadis autumnalis MCGREGOR, Man. Phil. Bds. (1909), 157.

It is strange that so large a bird as the glossy ibis was not recorded from the Philippine Islands until 1905. Mearns says that "great numbers of glossy ibises frequent the lakes and rivers of Mindanao," and he mentions having had two specimens, one of which he sent to the United States National Museum. Mr. W. Cameron Forbes, then Governor-General of the Philippine Islands, told me that in March, 1910, he saw many ibises on Bulusan Lake, in the interior of Cotabato Province, Mindanao. As he expressed it, "there were easily hundreds" of ibises. Mr. Forbes collected two specimens in Mindanao in

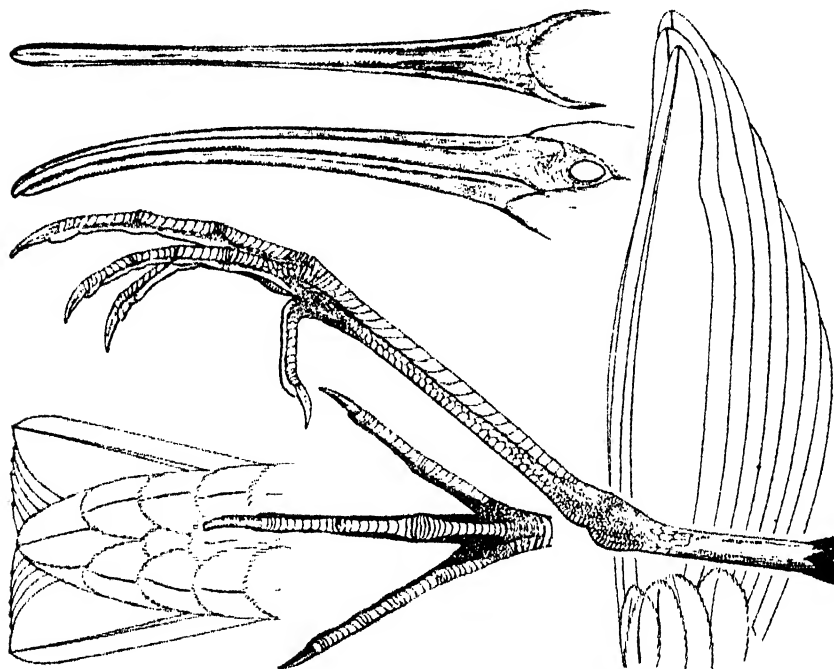


FIG. 7. *Plegadis autumnalis* (Linnaeus). One-half actual size.

1913, one of which (No. 13279) he presented to the Bureau of Science; the other was sent to Harvard College. Mr. A. O. Zinn collected a glossy ibis on Laguna de Bay, Luzon, which he presented to the Bureau of Science (No. 13278). This specimen was killed on November 15, 1911; it is a male in winter plumage. Dr. H. C. Curl, formerly stationed at the Cafiacao Naval Hospital, Cavite Province, contributed a fine skin of the glossy ibis (No. 12980) to the Bureau of Science collection. This is a female in summer plumage and was killed by Doctor Curl near Cavite on September 14, 1909.

In this species the female is somewhat smaller than the male, and the bill and the legs are very noticeably shorter, as shown in the table of measurements.

TABLE III.—Measurements of *Plegadis autumnalis*.

Bureau of Science No.	Locality.	Date.	Sex.	Wing.	Tail.	Bill from frontal feathers.	Tarsus.	Middle toe with claw.
				mm.	mm.	mm.	mm.	mm.
12880	Cavite, Luzon	Sept. 14, 1909.	♀	260	92	109	85	70
13278	Laguna de Bay, Luzon	Nov. 15, 1911.	♂	260	98	124	101	82
13279	Cotabato, Mindanao	Mar. 24, 1913.	♂	278	96	138	103	82

Fregata ariel (Gould).

Fregata ariel WHITEHEAD, Ibis (1899), 500 (Cape Engaño, Luzon); MCGREGOR, Man. Phil. Bds. (1909), 207.

A female man-of-war bird was secured at Malabon, near Manila, on August 21, 1917. This specimen was taken shortly after a storm and was mounted for the owner. The stomach contained about twenty small round worms, which Prof. L. D. Wharton tells me belong to the family Heterakidæ. The following color notes were taken from the specimen the day after it was killed: Skin around eye dark carmine; bill parula blue, nail pale blue, skin between rami light bluish violet mottled with dark carmine; legs pale dull blue slightly mottled with pomegranate purple, nails light drab.

Whitehead's statement concerning this species, "Not uncommon in the Philippines," does not express the results of my experience. I have seldom seen either this or the larger species.

Anhinga melanogaster Pennant. Plate II.

In June, 1917, Dr. Alvin J. Cox, director of the Bureau of Science, brought from Mindoro Island a living specimen of the Indian darter. This bird had been slightly wounded by a single small shot, which had entered near the base of the bill. The bird was placed in a cage and in a few days had completely recovered.

There has never been any trouble in feeding this bird, except to get enough fish to satisfy it. The bird has always eaten readily and has never shown any fear of man. At first the fishes were placed in a pan of water in the cage, and the bird picked them up one by one, tossed them into the air, and caught them head first. When its hunger became partially appeased,

it played with the fishes without picking them up or tossed them into the air and failed to catch them and then worried them around in the water pan. Later the fishes were thrown to the bird, one by one, and it now catches them on the fly almost without a miss. After catching a fish, the bird always throws it into the air to get it headed in the right direction. One day this bird caught and swallowed twenty-two small fishes almost as fast as they could be tossed to it. At this time we gave no more, as our supply was exhausted. The fishes fed each day are small sardines and similar kinds 60 to 75 millimeters long and about 20 millimeters deep.

The darters are well known for their habit of standing with the wings extended as if hung out to dry. Our specimen expands its wings at frequent intervals during the day, and at such times it displays accurate muscular control of the feathers. The long scapular feathers are raised so that they stand at various angles to the back; the alula extends free from the wing; the upper and the under wing coverts and the feathers along the edge of the wing are raised almost at right angles to the respective surfaces from which they originate. Some of these raised feathers can be distinctly seen in the photographs (Plate II). These feathers are often raised when the wings are folded. The characteristic transverse ribs of the larger scapular feathers can be seen in one of the photographs. Our specimen often flaps its wings vigorously before spreading them. In this way the tips of the primaries have become worn off against the wire netting of the cage. The only vocal effort I have heard this bird make is a weak, monosyllabic, guttural *kuak*, uttered two or three times with about one-second intervals. The note is used to express a state of contentment or of excitement.

Several times I have carefully approached the cage after dark and have always found the bird with its head buried in the feathers far down its back. I have found it in this position in the daytime. It awakes very readily, even so slight a sound as that made by opening a wooden match box may disturb it. At times it rests on one foot, the toes of the other being curled up. It is very adept at scratching itself. It may begin near the base of the bill and vigorously comb the feathers of the neck, working gradually toward the body for several centimeters. The long neck greatly facilitates the preening process, and the bird spends much time in this part of its toilet. The

longer feathers are passed between the mandibles, and the short feathers of the body and lower neck are vigorously manipulated with the tip of the bill. This individual is almost constantly engaged in some activity, and the number of peculiar positions into which it can twist its neck is surprising. We secured photographs of some of these, but they do not include the most awkward positions nor show the remarkable loop formed by the neck when the bird preens the feathers of its throat.

The following color notes were made from this living bird and from a specimen killed when this one was captured: Iris honey yellow, the outer border and a narrow inner ring primuline yellow; skin below eye dark olive-ocher, above eye and at base of bill light yellowish olive; bill yellowish olive, but proximal half of lower mandible light orange-yellow; tarsi deep to dark olive-gray in front, iron-gray or darker behind; toes dark olive-gray, webs yellowish olive.

Pithecophaga jefferyi Grant. Plate III, figs. 1 and 2; text fig. 8.

Pithecophaga jefferyi GRANT, Bull. Brit. Orn. Club. (1896), 6, 17; Ibis (1897), 214, Pl. V, text figs. 1-4 (Samar); MCGREGOR, Man. Phil. Bds. (1909), 226; SETH-SMITH, Ibis (1910), 286 and 758, Pl. IV, text fig. 4 (Mindanao).

Although the monkey-eating eagle has been definitely recorded from Luzon, its size and rarity warrant the recording of additional notes of its occurrence. Through the interest and the efforts of Gov. E. A. Eckman and Gov. Leo J. Grove a living bird of this species was sent to the Bureau of Science in January, 1917. The specimen was captured at an altitude of about 1,200 meters on Mount Ballong, which is 6 kilometers west and a little south of Imugan, Nueva Vizcaya Province, Luzon. This is the most northern record of this eagle. Although I saw a large eagle, probably of this species, at Irisan, Benguet Province, the record must be always considered doubtful.

Governor Grove kindly furnished the following notes about the specimen secured by him:

The eagle was caught with a bait and a snare. The bait was a small pig and after it was placed several rattan nooses were placed around it so that when the eagle made his swoop for the pig he would have to enter one of them which drew tighter the more it struggled. The nooses were made quite large but not large enough for the wings to pass through. The noose being struck by the wings with the velocity of the body of the eagle was caused to tighten and hold the bird securely. The same men have promised to get me the mate of this one, but as they were six months getting the one we have I have not very many hopes of their success.

The photographs of the head (Plate III, figs. 1 and 2) clearly

show the characteristic form of the bill, the narrow vertical nostril, the hairs on the cere, the deeply sunk eye, and the lanceolate feathers of the crest. The iris was pale blue, a very unusual color for the eye of a raptorial bird; bill dark green-blue gray, distal half black; tarsus and feet pale dirty yellow; nails

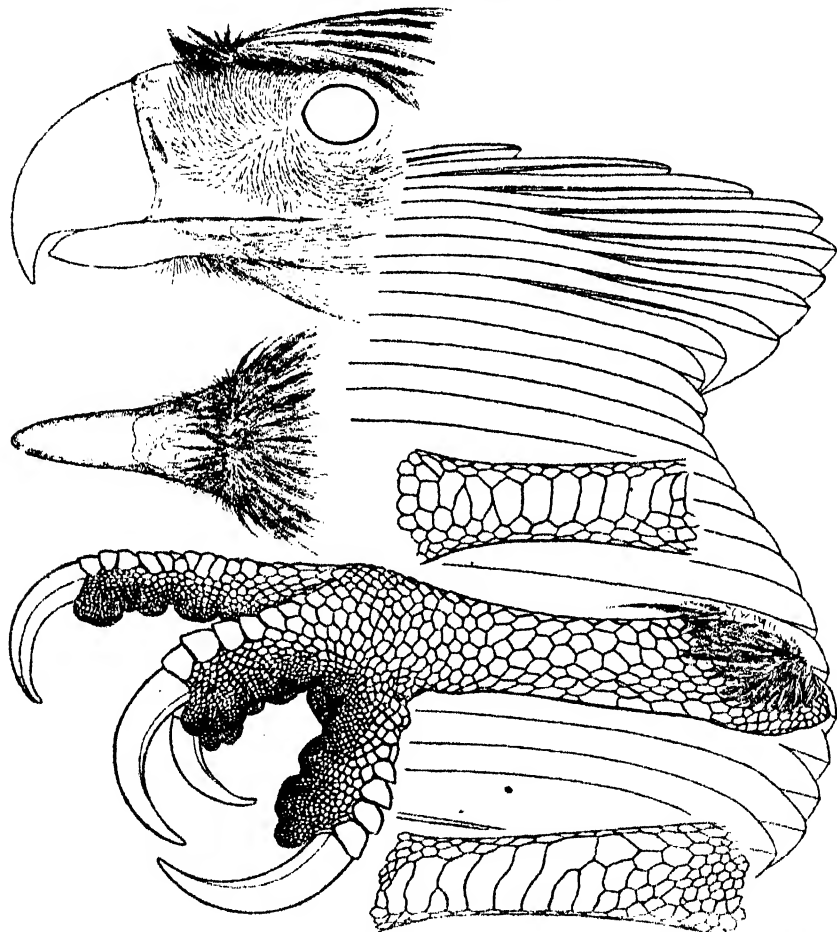


FIG. 8. *Pitheophaga jefferyi* Grant, generic details. The lower mandible is retracted or worn. The outline of the wing is one-fourth actual size, the other parts are one-half actual size.

black. After the photographs had been taken at the Bureau of Science, the living bird was deposited in the Manila botanic garden, where it is still living (January 1, 1918).

The text figures presented herewith were made from the specimen collected by Harry M. Ickis in Laguna. I am unable to figure the tail, as that member was missing from the material

given to me by Mr. Ickis and the tail of the mounted specimen in the Bureau of Science collection is very imperfect. This species has a very full crest, which the bird often expands, as is well shown in the front view of the head published by Seth-Smith (his fig. 4).

Chaetura dubia McGregor. Fig. 9.

Chaetura dubia MCGREGOR, Bur. Govt. Laboratories (1905), No. 34, 15, Pl. XII (Mindoro).

On April 2, 1911, Dr. and Mrs. H. C. Curl collected near Cavite, Luzon, a large spine-tailed swift (No. 13270). This specimen is in somewhat worn plumage, but in colors and markings it cannot be distinguished from the type of *Chaetura dubia*. This appears to be the first positive record of any species of this genus from Luzon.

In 1902 I observed large swifts near Mariveles, Bataan Province; and in January, 1913, at Dupax, Nueva Vizcaya Province, large swifts flew over the town low enough to tempt us to shoot at them. It was impossible for me to determine to what species these belonged, but that they were one of the large species of *Chaetura* there can be no doubt. The immense size of these birds and the grace and high speed of their flight are extremely characteristic.

The following letter refers to some species of *Chaetura*:¹

BAGUIO, March 16th, 1910.

MY DEAR MR. MCGREGOR: The first Sunday after my arrival I rode my big horse to the top of Santo Tomas, over a pretty good trail. I saw a number of birds about there but the thing that particularly interested me was two pairs (apparently) of *Chaetura*, which were chasing each other about the very summit of the mountain and repeatedly passed within ten feet of my head. I have heretofore believed that the Luzon representative of this species did not have the white spots in front of the eyes, but am now forced to change my opinion. I am quite positive that I saw these white spots but as you know, this bird flies with tremendous velocity and I could not be absolutely certain that this was the case. I am now of the opinion that it will prove identical with the Mindoro species or closely allied to it.

Sincerely yours,

DEAN C. WORCESTER,
Secretary of the Interior.

Ridgway² has made *Chaetura picina* Tweeddale the type of a genus, *Mearnsia*. If this genus be recognized, *Hirundapus*

¹ See also previous note by Mr. Worcester, *This Journal* (1906), 1, 766.

² *Bull. U. S. Nat. Mus.* (1911), 50, Pt. V, 686.

Hodgson must be revived for the large spine-tailed swifts, which Ridgway has done.*

In Ridgway's key to the genera, *Hirundapus* is said to have the "tenth (outermost) primary longest, or at least not distinctly shorter than the ninth." I find that this is true of more than thirty specimens of *Chætura gigantea* (Temminck). In the type and the cotype of *Chætura dubia*, both in perfect plumage,

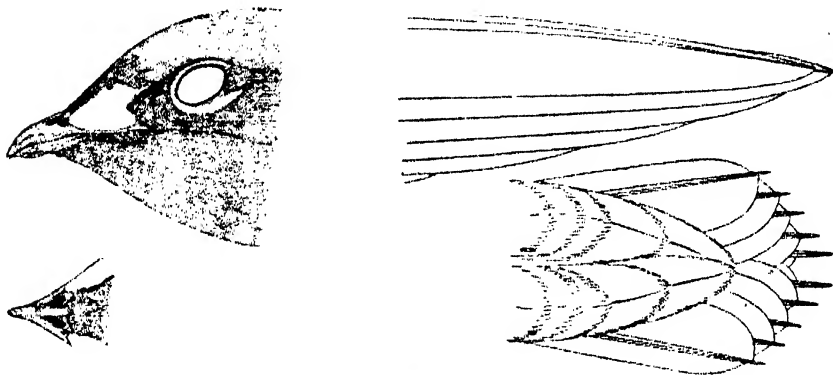


FIG. 9. *Chætura dubia* McGregor. Actual size.

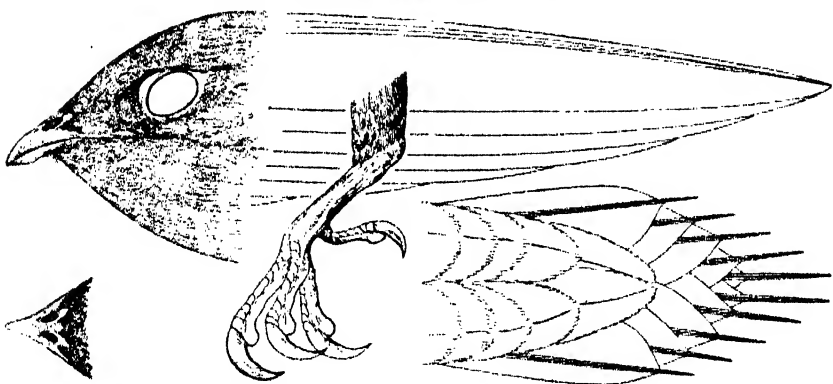


FIG. 10. *Chætura gigantea* (Temminck), generic details. Actual size.

the outermost primary is shorter than the next one (compare figs. 9 and 10). In the third specimen, from Cavite, of the latter species the tips of the primaries are badly abraded, so that it is impossible to say which was the longest. The difference in the length of the tail spines in these two species is shown in the text figures. The shorter spines do not seem to have been abraded.

* Loc. cit.

I have not seen a specimen of *Chætura picina*, the type of which was collected by Everett in Mindanao. Whitehead secured three specimens in Leyte, and I think the late E. A. Mearns told me that he had collected one or more specimens in Mindanao.

***Micropus subfurcatus* (Blyth).**

Cypselus subfurcatus MCGREGOR, Phil Journ. Sci., Sec. A (1907), 2, 346, Pls. IV and V, fig. 2 (Camiguin Island, north of Luzon).

Micropus subfurcatus MCGREGOR, Man. Phil. Bds. (1909), 362.

Mr. W. Cameron Forbes collected a specimen of this swift at Sagada, Bontoc, Mountain Province, Luzon, on May 23, 1913. The sex was not determined. The specimen is in the collection at Harvard College. The only other Philippine specimen of *Micropus subfurcatus* is the one in the Bureau of Science, collected by me on Camiguin Island, north of Luzon.

***Zosterornis plateni* (Blasius).**

Mixornis plateni BLASIUS, Journ. f. Orn. (1890), 147.

Zosterornis plateni GRANT, Ibis (1897), 233 (in key to species); MCGREGOR, Man. Phil. Bds. (1909), 530.

Only the type specimen of this *Zosterornis* seems to be known. In a small collection of birds obtained by Mr. W. Cameron Forbes at Malabang, Mindanao, on July 31, 1913, I noted a male *Zosterornis* that was undoubtedly *Mixornis plateni*. The following description was written at the time that I examined the specimen:

Male.—Back olive-brown, with faint whitish shaft stripes, slightly rusty on occiput, tail coverts, and edging of rectrices; feathers of forehead, sides of head, chin, and throat black with conspicuous, white shaft stripes; sides of neck and breast rusty and with white shaft stripes; middle of chest and of abdomen and tail coverts white; sides olivaceous; edging of wing feathers dull olivaceous; axillars and lining of wing white; inner edges of primaries and secondaries ochraceous-white. This species is one-third less in size than *Zosterornis capitalis*, *nigrocapitalis*, or *affinis*; and the colors, especially of the head, the chin, and the throat, are remarkably different. The white shaft stripes of these parts are particularly noticeable. Wing, 51.5 millimeters; tail, 44; exposed culmen, 10; tarsus, 15; middle toe with claw, 13. The specimen is now in the collection at Harvard College.

The above measurements agree closely with those of the type: "♀ Long. tot. 12 cm. Ala 5.5 cm. Caud. 4.7 cm. Culmen 1.0 cm. Tarsus 1.5 cm."

ILLUSTRATIONS

PLATE I

Leucotreron merrilli McGregor, from the type and from a living bird.
Drawn and colored by T. Espinoza. $\times 0.5$.

PLATE II

Anhinga melanogaster Pennant, from a living bird.

PLATE III

FIGS. 1 and 2. *Pithecophaga jefferyi* Grant, from a living bird.

FIG. 3. *Gallinago megala* Swinhoe, a partial albino. Photograph of a specimen mounted by the Bureau of Science.

TEXT FIGURES

[Drawings by M. Llagaya.]

FIG. 1. *Mesoscolopax minutus* (Gould), generic details, from a female.
 $\times 1$.

2. *Macrorhamphus semipalmatus* (Jerdon), generic details, from a female. $\times 1$.

3. *Totanus stagnatilis* Bechstein, generic details, from a male. $\times 1$.

4. A, *Gallinago gallinago* (Linnæus); b, *G. stenura* (Bonaparte).
Tails, showing the difference in the rectrices. $\times \frac{1}{2}$.

5. *Gallinago megala* Swinhoe, generic details. $\times \frac{1}{2}$.

6. *Lobipes lobatus* (Linnæus), generic details. $\times 1$.

7. *Plegadis autumnalis* (Linnæus), generic details, from a male.
 $\times 0.5$.

8. *Pithecophaga jefferyi* Grant, generic details, from the Ickis specimen [see *This Journal*, Sec. A (1907), 2, 297]. The lower mandible is worn or retracted. Wing, $\times 0.25$; bill and foot, $\times 0.5$.

9. *Chætura dubia* McGregor, generic details, from the type. $\times 1$.

10. *Chætura gigantea* (Temminck), generic details, from a male. $\times 1$.



PLATE I. LEUCOTRERON MERRILLI MCGREGOR ONE-HALF ACTUAL SIZE



PLATE II. ANHINGA MELANOGASTER PENNANT.



Fig. 1. *Pitheophaga jefferyi* Grant.



Fig. 2. *Pitheophaga jefferyi* Grant.



. 3. *Gallinago megala* Swinhoo.

NOTES ON THE PHILIPPINE MEMBRACIDÆ

By W. D. FUNKHOUSER

(From the Entomological Laboratory of Cornell University, Ithaca)

ONE PLATE

In a paper published in 1915¹ an attempt was made to review all of the species of Membracidæ known from the Philippine Islands at that time, and tables were given that should aid in their recognition.

Since that date the papers published by Distant² and the supplementary volume of the Homoptera of British India³ by the same author have added some valuable data to the literature of the East Indian forms, while the continued collecting of Prof. C. F. Baker, of Los Baños, has brought to light a number of interesting new species. Also Mr. Distant has very kindly compared for me some of the questionable forms with the type specimens of Walker in the British Museum, and Professor Baker has called attention to the fact that two records in literature were overlooked in the former paper. For these reasons the following notes are given to bring the knowledge of the family up to date in regard to the Philippine fauna.

Unfortunately there are yet no data on the biology of the species, so that these additions are entirely from a systematic viewpoint.

I am again greatly indebted to Professor Baker, who has so kindly furnished me with all of the new material.

Genus *XANTHOSTICTA* Buckton

Buckton⁴ has described three species of the genus *Bolbonota* from the Islands. It seems improbable that this genus should be thus represented, as the insects representing the genus are native of an entirely distinct faunal area, and no other species of the subfamily Membracinæ, to which *Bolbonota* belongs, have

¹ Funkhouser, W. D., Review of the Philippine Membracidæ, *This Journal*, Sec. D (1915), 10, 365-405.

² Distant, W. L., Rhynchotal notes, *Ann. & Mag. Nat. Hist.* (1915), VIII, 16, 322-328, 489-496; (1916), 17, 149-159, 313-330; 18, 19-44.

³ Distant, W. L., Fauna of Brit. Ind., Rhynch. VI, Hom. Append., viii and 248 pp. London, March, 1916.

⁴ Buckton, G. B., Monograph of the Membracidae (1908), 64.

ever been recorded from the Philippines. It seems likely that Buckton has made a wrong generic diagnosis, but the type specimens are not available for examination. In discussing the matter, Mr. Distant states (in correspondence) :

I have not seen either *Bolbonata grisea* Buckt. or the two following species which he describes from the Philippines. They are clearly not congeneric with *Bolbonota*.

Buckton, however, apparently recognized the fact that these forms did not fit exactly into the genus to which he assigned them, for in a footnote⁵ he mentions "the different appearance and the non-spatulate tibiae" of these species and suggests "a new genus called provisionally *Xanthostieta*" to include them. For purposes of cataloguing it seems necessary to erect this genus for the accommodation of the species under discussion, since it is clear that they cannot be correctly assigned to *Bolbonota*.

***Xanthostieta grisea* Buckton.**

Bolbonata grisea BUCKTON, Mon. Memb. (1903), 63, Pl. 9, fig. 7.

The species has never been recognized since the original description, which follows :

Smaller than *B. luzonica*, the next species to be described; colour ashy-grey; pronotum without dorsal carinations; tegmina one-third pale from the tips, the other two-thirds dark brown; abdomen with the segments edged with white.

The legs both of this and *B. luzonica* show but little of the spatulate character seen in the ordinary species of *Bolbonota*.

Size in expanse of the wings, 6 x 8 mm.

Habitat.—Philippines. H. Cuming. (Hope Coll.)

***Xanthostieta luzonica* Buckton (Westwood in Hope coll.).**

Bolbonata luzonica BUCKTON, Mon. Memb. (1903), 64, Pl. 9, fig. 8; *ibid.*, 75.

Like the preceding, this species is known only by the original description of Buckton, which follows :

Head wide with prominent eyes; pronotum with a sharp pointed apex; the dorsal part with three rough carinae separated by deep furrows or sulci; tegmina roundish, orange-brown with whitish tips followed by brownish stains near the apices; one-third near the base dark brown; wings delicate and hyaline, with four radials and no limbus.

Expanse, 7 x 3 mm.

Taken by H. Cuming, Esq. in the Philippine Islands.

It is named by Westwood in the Hope Coll.

***Xanthostieta trivialis* Buckton.**

Bolbonota trivialis BUCKTON, Mon. Memb. (1903), 64, Pl. 10, fig. 1.

⁵ *Ibid.*, footnote, p. 63.

Buckton's description follows:

Pronotum without carinations; metopidium and part of the dorsum ochreous; tegmina dark brown with coarse but obscure neuration; the wings ample and hyaline. In the figure these wings are seen spread outside the tegmina; legs scarcely if at all spatulate.

This somewhat obscure insect is figured as being an example taken in the Philippine Islands of a genus usually thought to be exclusively American. Size, 3 x 2 mm.

Taken by H. Cumming. (Hope Coll.)

Habitat.—Luzon.

Genus CENTROCHARES Stål**Centrochares posticus Buckton.**

Pterygia postica BUCKTON, Mon. Memb. (1903), 70, Pl. 11, figs. 4-5a.

Centrochares horrificus (in part) FUNKHOUSER, Phil. Journ. Sci., Sec. D (1915), 10, 370.

Centrochares posticus DISTANT, Ann. & Mag. Nat. Hist. (1916), VIII, 17, 314.

Distant recognizes the male of *C. posticus* as distinct from *C. horrificus*, of which I considered it a synonym, and regards the female as still another species.

Centrochares bucktoni Distant.

Pterygia postica ♀ ? BUCKTON, Mon. Memb. (1902), 70, Pl. 11, fig. 4a.

Pterygia postica (as syn.) FUNKHOUSER, Phil. Journ. Sci., Sec. D (1915), 10, 370.

Centrochares bucktoni DISTANT, Ann. & Mag. Nat. Hist. (1916), VIII, 17, 314.

The recognition of the female of *Pterygia postica* as a distinct species and its dedication to Buckton are given without comment by Distant in his rhynchotal notes. I am still unconvinced that a long series of *C. horrificus* will not show forms that will include both *C. postica* and *C. bucktoni*. The species shows a great deal of variation.

Centrochares horrificus Westwood.

Centrochares horrificus DISTANT, Ann. & Mag. Nat. Hist. (1915), VIII, 16, 327.

Add: *Habitat*.—MINDORO, Baco River (*J. J. Mounsey*).

Genus PYRGONOTA Stål***Pyrgonota longiturris* sp. nov. Plate I, figs. 1 and 2.**

Nearly uniform ferruginous brown, front of pronotal horn and face slightly darker than the rest of the body; entire body and tegmina densely punctate; tegmina opaque; posterior process decurved, reaching beyond internal angle of tegmina, but not to its tip; thorax armed with teeth on lateral margins; tibiae

of all three pairs of legs much flattened; pronotal horn longer than distance from front of head to tips of tegmina.

Head longer than broad, somewhat foliaceous, brown, lightly punctate and pubescent with golden hairs; eyes prominent, dark brown; ocelli yellowish, farther from each other than from the eyes and situated slightly above an imaginary line drawn through centers of eyes; clypeus large, distinctly three-lobed, tip hirsute.

Pronotum brown, darker in front, uniformly punctate, slightly pubescent; pronotal horn very long, porrect, straight and laterally compressed except the tip, which is sharply bent backward and expanded into a flat, spreading plate; median carina percurrent; humeral angles not prominent, obtuse, extending laterally beyond the eyes for a distance as great as the width of the eyes; posterior process long, slender, acuminate, sinuate, decurved at tip, extending beyond internal angle of tegmina.

Tegmina coriaceous, opaque, brown, punctate, veins indistinct, external and internal angles sharp, tip pointed.

Legs and undersurface of body brown; lateral margins of thorax armed with teeth; tibiae of all legs flattened, spined; legs and prothorax slightly powdered with white coating; claws brown.

Length from front of head to tip of tegmina, 7 millimeters; height of pronotal horn from humeral angles to tip, 8; width between humeral angles, 2.

LUZON, Laguna, Mount Maquiling (*Baker*).

Type, a female specimen in Professor Baker's collection.

Genus LEPTOCENTRUS Stål

Leptocentrus reponens Walker.

Add: *Habitat*.—MINDANAO, Davao (*Baker*), Baker's duplicate No. 6470.

Genus CENTROTYPUS Stål

The genus *Centrotypus* is characterized as follows: Posterior process present; tibiae simple; underwings with four apical areas; thorax elevated; two suprahumeral horns; tegmina with five apical areas; scutellum plainly visible at sides; no cross vein at base of tegmina.

Centrotypus aduncus Buckton.

Leptocentrus aduncus BUCKTON, Mon. Memb. (1903), 236, Pl. 53, fig. 6; FUNKHOUSER, Phil. Journ. Sci., Sec. D (1915), 10, 380.

Centrotypus aduncus DISTANT, Ann. & Mag. Nat. Hist. (1916), VIII, 17, 318.

The assignment of this species to *Centrotypus* adds a new genus to the check list of the Philippine forms. Distant presumably had access to Buckton's type material, so that this species, which was tentatively placed under *Leptocentrus* in the earlier review, may be now assigned a definite position.

Genus **IBICEPS** Buckton

The genus *Ibiceps* was erected by Buckton* to include those species in which the long suprahumeral horns are sharply bent backward at their tips. In other respects the genus is close to *Leptocentrus*, having the posterior process not elevated above the body, the tegmina pointed at the tips, and five apical areas and two discoidals. Buckton states that the neuriation is not constant, but that the discoidal areas may be subdivided.

This genus has been added to the Philippine fauna by the description of a new species and the reduction of an old one to synonymy.

Ibiceps erigens Walker.

Centrotus erigens WALKER, List. Hom. Brit. Mus. (1851), 614, 43.

Sertorius erigens STÅL, Hem. Phil. (1870), 727.1; FUNKHOUSER, Phil. Journ. Sci., Sec. D (1915), 10, 383.

Ibiceps erigens DISTANT, Ann. & Mag. Nat. Hist. (1916), VIII, 17, 150.

With the reduction of this species to synonymy, the genus *Sertorius* is eliminated from the Philippine list where, indeed, it is doubtful if it should have been ever placed. If as noted in the former discussion⁷ that the genus was of very doubtful standing and was included only tentatively.

Ibiceps mounseyi Distant.

Ibiceps mounseyi DISTANT, Ann. & Mag. Nat. Hist. (1916), VIII, 17, 150.

Known only from Distant's recent description which follows:

Head and pronotum black; a frontal lateral pronotal fascia on each side, two distinct discal pronotal fasciae, a central fascia to face, the clypeus, and lateral sternal areas greyish pubescent; tegmina stramineous, apical area dark castaneous, base, costal and subcostal areas and apical margin black; legs testaceous; abdomen beneath black, excluding apical area, greyish pubescent; pronotum coarsely punctate, the anterior produced processes almost horizontal, very slightly recurved, their apices acute, disk centrally carinate, posterior process tricarinate and passing the posterior angle of the inner tegminal margin, frontal area strongly carinate.

* Buckton, G. B., Monograph of the Membracidae (1903), 239.

⁷ Funkhouser, W. D., *This Journal*, Sec. D (1915), 10, 382.

Long., incl. tegm., 12 mm.; exp. ant. pronot. process, 5 mm.

Hab. Philippine Islands (J. J. Mounsey).

Allied to *I. erigens* Walk., but differing by the much more slender and less curved pronotal processes, etc.

Genus *TRICENTRUS* Stål

Tricentrus orcus Buckton.

Centrotus orcus BUCKTON, Mon. Memb. (1903), 247, Pl. 60, figs. 7, 7a, 7b; FUNKHOUSER, Phil. Journ. Sci., Sec. D (1915), 10, 390.

Tricentrus orcus DISTANT, Ann. & Mag. Nat. Hist. (1916), VIII, 17, 390.

The transfer of this species from the genus *Centrotus* to the genus *Tricentrus* was to have been expected. It is very doubtful if the old genus *Centrotus* as now limited is represented in the Island fauna.

The species has not been recognized in any of the material studied in connection with this report. The measurements given by Buckton (5 x 3 mm.) are small for the majority of the species of this genus unless referring only to males. It may be that Buckton had only male specimens before him and that this species may prove to be the opposite sex of some other species described from females.

Tricentrus pilinervosus Funkhouser.

Add: *Habitat*.—LUZON, Benguet, Baguio (*Baker*). MINDANAO, Davao (*Baker*), *Baker's* duplicate Nos. 6307 and 6471.

Tricentrus attenuatus Funkhouser.

Add: *Habitat*.—MINDANAO, Davao (*Baker*), *Baker's* duplicate No. 6473.

Tricentrus robustus sp. nov. Plate I, figs. 3 and 4.

Near *Tricentrus fairmairei* Stål, but larger and darker and differing principally in the shape and position of the supra-humeral horns, which are larger, more flattened, higher, and directed more dorsad.

Heavy, robust, very dark brown, thickly punctate, densely pubescent with golden hairs. Suprahumeral horns heavy, laterally compressed, extending upward and outward. Posterior process short, heavy, suddenly acute at tip, reaching just beyond internal angle of tegmen. Tegmina ferruginous hyaline, base black and punctate, white fascia of body showing through tegmina just behind base. Position of horns somewhat variable. Males smaller and darker than females.

Female.—Head subquadrate, black, convex, delicately ridged

rather than punctate, pilose with long golden hairs; eyes prominent, dark brown; ocelli amber-colored, nearly equidistant from each other and from the eyes and situated slightly above a line drawn through centers of eyes; clypeus large, extending far below inferior margin of face, tip truncate and hirsute.

Pronotum uniformly, closely punctate, densely pubescent, darker on metopidium, suprahumeral horns, and tip of posterior process; median carina percurrent; humeral angles prominent, obtuse; suprahumeral horns thick, heavy, compressed, widely separated at their bases, gradually acute, extending outward and upward with tips slightly curved backward; posterior process short, heavy, sharply carinate above, tip suddenly acute, slightly upraised and extending just beyond internal angles of tegmina.

Tegmina smoky hyaline tinged with ferruginous; base black and punctate; veins distinct and hairy; a white fascia at base of abdomen clearly seen through tegmina.

Legs and undersurface of body very dark chocolate; densely pubescent; knees ferruginous; tibiae closely spined.

Length to tips of tegmina, 7 millimeters; width between extremities of horns, 4.2.

Male.—Smaller and darker than female; horns shorter; posterior process not upraised at tip; tegmina uniform dark brown, almost opaque, base black, very little or no white showing through; thighs dark brown, tibiae ferruginous.

Length, 6 millimeters; width, 3.

LUZON, Benguet, Baguio (*Baker*); Nueva Vizcaya, Imugan (*Baker*); 7 males and 2 females.

Type (female) and four paratypes (*Baker's* duplicate Nos. 4910, 4911, 4912, 7638) in my collection; allotype and three paratypes (unnumbered) in Professor *Baker's* collection.

Tricentrus projectus Distant.

A female specimen is slightly larger than the described type, but I can find no differences of specific value.

LUZON, Nueva Vizcaya, Imugan (*Baker*).

Tricentrus laticornis sp. nov. Plate I, figs. 5 and 6.

Near *T. robustus*, but differing in size, color, and particularly in the structure of the suprahumeral horns.

Uniform light castaneous, thickly covered with bright golden pubescence. Suprahumeral horns very broad and wide-spreading and showing a rough, irregular dorsal carina. Posterior process short, stout, gradually acute, black at tip, reaching just

beyond internal angle of tegmen. Tegmina smoky hyaline, dark brown, punctate and pubescent at base. Legs castaneous; undersurface of body dark brown.

Head subquadrate, dark brown, so thickly covered with short, shining golden hairs as to conceal completely the weak puncturation; eyes prominent, castaneous; ocelli not prominent, concolorous with rest of face, about equidistant from each other and from the eyes and situated slightly above a line drawn through centers of eyes; clypeus large, convex, extending far below inferior margin of face, tip truncate, somewhat recurved and densely pubescent.

Pronotum uniformly castaneous, densely punctate, pubescent with golden hairs; metopidium convex, slightly darker in color above eyes; median carina distinct and percurrent; humeral angles not prominent, blunt; suprahumeral horns very heavy, broad, extending upward and outward, compressed dorsoventrally with a short, irregular ridge on the upper surface near the posterior margin, extending from the tip two-thirds the distance to the base, anterior and posterior margins of horns sharp, ventral surface bearing a strong carina, the horns about as long as the distance between their bases; scutellum very distinct, dark brown and punctate; posterior process short, heavy, gradually acute, tricarinate, tip black or very dark brown, extending just beyond internal angles of tegmina.

Tegmina smoky hyaline tinged with castaneous, dark brown and punctate at base, base and costal margin somewhat pubescent.

Legs uniformly castaneous, tibiae spined; undersurface of body dark brown; sides of thorax densely pubescent.

Length to tips of tegmina, 6.8 millimeters; width between extremities of suprahumeral horns, 5.

LUZON, Nueva Vizcaya, Imugan (*Baker*).

Type, a female, Baker's duplicate No. 7640.

Tricentrus fasciipennis sp. nov. Plate I, figs. 7 and 8.

Slender, dark brown, thickly punctate, densely pubescent, particularly on head, metopidium, and sides of thorax; suprahumeral horns long, slender, sharp, recurved; posterior process long, slender, slightly decurved at tip, extending well beyond internal angles of tegmina; tegmina distinctly banded with brown.

Head subquadrate, nearly as long as broad, thickly covered with long silvery hairs that conceal the slight puncturation; eyes very large and prominent; ocelli grayish brown, not conspicuous, almost equidistant from each other and from the eyes and situated slightly above a line drawn through centers of eyes;

clypeus very long and slender, extending far below inferior margin of face, tip rounded and hirsute.

Pronotum dark brown, darker below suprahumeral horns, densely punctate and thickly pilose between and below horns; metopidium almost straight; median carina weakly percurrent; humeral angles rounded; suprahumeral horns long, slender, sharp, extending upward, outward, and with tips turned backward, carinate above and below as well as anteriorly and posteriorly; posterior process long, slender, sharp, somewhat sinuate, tricarinate, tip slightly bent downward and extending well beyond the internal angle of tegmen, but not reaching apex.

Tegmina sordid hyaline, base reddish brown and punctate, immediately following base a white band, immediately following this a broad dark brown band, both these bands extending entirely across the tegmen, apical margin slightly bordered with ferruginous.

Undersurface of body and sides of thorax very dark brown, almost black, and thickly pubescent; legs castaneous, femora darker, tibiae spined.

Length to tips of tegmina, 7 millimeters; width between extremities of horns, 4; width between bases of horns, 1.

LUZON, Nueva Vizcaya, Imugan (*Baker*). Described from a unique female specimen in Professor Baker's collection.

Genus SIPYLUS Stål

Sipylus crassulus Stål.

Add: *Habitat*.—LUZON, Nueva Vizcaya, Imugan (*Baker*).

Sipylus dilatatus Walker.

Centrotus dilatatus WALKER, List. Hom. Brit. Mus. (1851), 630.74;

FUNKHOUSER, Phil. Journ. Sci., Sec. D (1915), 10, 390.

Sipylus nodipennis FUNKHOUSER, Journ. Ent. & Zool. (1914), 6, 72.15, fig. 5; Phil. Journ. Sci., Sec. D (1915), 10, 392, Pl. 2, fig. 15.

Sipylus dilatatus DISTANT, Ann. & Mag. Nat. Hist. (1916), VIII, 17, 330.

Mr. Distant has very kindly compared my paratypes of *Sipylus nodipennis* with the type specimen of Walker's *Centrotus dilatatus* in the British Museum and pronounces the species identical. Walker's very meager description of a headless specimen with the omission of certain very necessary data³ is perhaps sufficient explanation of the redescription of the species.

Add: *Habitat*.—MINDANAO, Davao (*Baker*).

³ Cf. Funkhouser, *This Journal*, Sec. D (1915), 10, 390; and Distant, *Ann. & Mag. Nat. Hist.* (1916), VIII, 17, 330.

Sipylus acuticornis sp. nov. Plate I, figs. 9 and 10.

Black with white tomentose patches below eyes and on sides of thorax; humeral angles produced into short, very sharp, prominent horns; posterior process long, slender, extending just beyond internal angles of tegmina; tegmina amber hyaline, base largely and sharply black and punctate; white patch at base of abdomen showing through tegmina.

Head wider than long, convex, black, finely punctate, densely pubescent with golden hairs; eyes large, prominent, brown; ocelli not prominent, yellowish, about equidistant from each other and from the eyes and situated slightly above a line drawn through centers of eyes; clypeus very much deflexed, extending far below inferior margin of face, tip blunt and hirsute.

Pronotum convex above head, black, punctate, pubescent; humeral angles produced into sharp, prominent horns that extend outward, slightly upward, and very slightly forward; median carina percurrent, faint over metopidium, prominent on posterior process; posterior process slender, dorsal carina sharp, tip somewhat deflexed, extending just beyond internal angles of tegmina.

Tegmina smoky hyaline tinged with amber; base black and punctate and sparingly pubescent, the coriaceous area ending in a definite line; white patch of body showing through tegmina just beyond basal area; tip narrowly margined with ferruginous.

Sides of head and thorax densely covered with white tomentose pubescence.

Legs and undersurface of body uniform deep brown; abdomen and legs densely pilose.

Length to tips of tegmina, 6.5 millimeters; width between extremities of humeral horns, 4. The male is slightly smaller.

LUZON, Nueva Vizcaya, Imugan (*Baker*), 1 female and 1 male.

Type (*Baker's* duplicate No. 7639) in my collection; allotype (unnumbered) in Professor *Baker's* collection.

Genus *CENTROTOSCELUS* Funkhouser

Centrotoscelus luteus sp. nov.

Near *C. typus* Funkhouser, but smaller and differing in color and markings.

Yellow, marked with brown, darker below; closely punctate, sparingly pubescent; metopidium strongly convex; posterior process dark brown at tip, extending just to internal angle of tegmen; tegmina concolorous yellow hyaline; humeral angles prominent; no suprahumeral horns; posterior trochanters armed with strong teeth.

Head brown, pubescent with long golden hairs, which conceal the weak puncturation; eyes prominent, brown; ocelli distinct, pearly, placed on slight elevations, somewhat nearer to the eyes than to each other and situated slightly above a line drawn through centers of eyes; clypeus extending far below the inferior margin of face, much deflexed, tip blunt and pilose.

Pronotum yellow, punctate, somewhat pubescent; metopidium very convex; median carina percurrent; humeral angles prominent; posterior process heavy, tip sharp, brown, and carinate above. Scutellum distinct, brown. Extremity of posterior process just reaching internal angle of tegmen.

Tegmina uniformly yellow hyaline, somewhat opaque and punctured at base.

Undersurface of thorax black with more or less white pubescence; abdomen brown; legs concolorous ferruginous-yellow; hind trochanters having strong teeth on inner sides.

Length to tips of tegmina, 5 millimeters; width between humeral angles, 2.5.

LUZON, Benguet, Baguio (*Baker*), 3 females and 2 males.

Type (female No. 6308) and two paratypes (*Baker's* duplicate Nos. 6308, 6309, and 6315) in my collection; allotype and paratype (unnumbered) in Professor *Baker's* collection.

Centrotoscelus concavus sp. nov. Plate I, figs. 11 and 12.

Dark rusty brown in females; black in males; punctures so fine as to be seen only with high magnification; sparingly and irregularly pubescent; pronotum concave above scutellum; metopidium marked with broad median black band; tegmina sordid white marked with brown, hardly transparent.

Head subquadrate, very convex, black; very finely punctate, sparingly pubescent with golden hairs; eyes prominent, brown; ocelli brown, nearer to the eyes than to each other and situated high on the head, well above a line drawn through centers of eyes; clypeus long, deflexed, extending far below inferior margin of face, tip slightly curved outward and sparingly pubescent.

Pronotum dark chocolate, very minutely punctate and sparingly pubescent; metopidium very convex with wide median band of black or dark brown; dorsum deeply depressed in middle; posterior process short, blunt, carinate above, tip darker in color and barely reaching to internal angles of tegmina.

Tegmina sordid yellow-white marked with brown, translucent rather than transparent; base ferruginous, punctate and weakly pubescent; brown marking sometimes extended in a rather reg-

ular and distinct band across tegmen below tip of posterior process.

Sides of thorax covered with white tomentose patch that is not distinct in all cabinet specimens.

Undersurface of body dark brown or black; legs uniform ferruginous; trochanters strongly spined.

Length to tips of tegmina, 5 millimeters; width between humeral angles, 2.3.

Male.—Darker and more slender than the female and with markings of tegmina more distinct.

LUZON, Benguet, Baguio (*Baker*); Nueva Vizcaya, Imugan (*Baker*); 3 females and 1 male.

Type (a female) and paratype (unnumbered) in Professor Baker's collection; allotype (*Baker's* duplicate No. 7642) and paratype in my collection.

Genus **GARGARA** Amyot and Serville

Gargara nigrofasciata Stål.

Add: *Habitat*.—MINDANAO, Davao and Dapitan (*Baker*).

Gargara nitidipennis Funkhouser.

Add: *Habitat*.—MINDANAO, Davao and Iligan (*Baker*); LUZON, Benguet, Baguio (*Baker*).

Gargara pygmaea Walker.

Add: *Habitat*.—MINDANAO, Davao (*Baker*).

Gargara tuberculata Funkhouser.

Add: *Habitat*.—MINDANAO, Davao and Zamboanga (*Baker*); LUZON, Tayabas, Malinao (*Baker*).

Gargara varicolor Stål.

Add: *Habitat*.—MINDANAO, Davao (*Baker*).

Gargara pulchripennis Stål.

Add: *Habitat*.—MINDANAO, Davao (*Baker*).

Gargara patruelis Stål.

Add: *Habitat*.—MINDANAO, Davao (*Baker*).

Gargara nigrocarinata Funkhouser.

Add: *Habitat*.—LUZON, Benguet, Baguio (*Baker*).

Gargara maculipennis sp. nov. Plate I, figs. 13 and 14.

Small, robust, dark brown species with tegmina beautifully decorated with brown and white; posterior process of pronotum

tectiform and not quite reaching the apical angles of the tegmina; sides of thorax white tomentose.

Head subquadrate, black, finely punctate, densely pubescent with golden hairs; eyes prominent, brown; ocelli small, not prominent, pearly, much nearer to the eyes than to each other and situated well above a line drawn through centers of eyes; clypeus longer than wide, pubescent, tip rounded and extending far below the inferior margin of the face.

Pronotum very dark brown or black, finely punctate, pubescent with golden hairs; metopidium convex; median dorsal carina faintly percurrent; humeral angles prominent, obtuse; dorsum depressed in middle; posterior process short, thick, heavy, sharply carinate and elevated above, tip acute, extending not quite to the internal angles of tegmina.

Tegmina hyaline, much wrinkled, which causes the hyaline areas to appear whitish, marked with brown areas particularly at base, just below middle of posterior process, internal margin before apex, apex itself, and middle of costal margin; base punctate.

Sides of thorax covered with white tomentose patch; under-surface of body very dark brown or black; legs luteous; claws ferruginous.

Length to tips of tegmina, 4 millimeters; width between humeral angles, 1.8.

LUZON, Benguet, Baguio (*Baker*), 3 males.

Type (a male, Baker's duplicate No. 6311) and paratype (No. 6310) in my collection; paratype (unnumbered) in Professor Baker's collection.

Gargara pinguis sp. nov. Plate I, figs. 15 and 16.

Heavy, robust, thick-bodied, dark brown marked with black, punctate, pubescent, posterior process decurved at tip and extending well beyond internal angle of tegmen, tegmina very dark with apical margin lighter.

Head very convex, nearly perpendicular, black, thickly pubescent with fine golden hairs, which largely conceal the weak puncturation; eyes prominent, gray-black; ocelli small, pearly, nearer to the eyes than to each other and situated well above a line drawn through centers of eyes; inferior margin of face smooth, rounded; clypeus long, extending well below inferior margin of face, reflexed, tip rounded and hirsute.

Pronotum dark brown marked with black, densely and closely punctate, finely pubescent; metopidium sloping; median carina

weakly percurrent; humeral angles prominent, obtuse; posterior process nearly straight, except tip, which is decurved and closely pressed against abdomen, extending well beyond internal angle of tegmen, but not reaching its apex, tip darker with sometimes a lighter area before it.

Tegmina very dark, appearing almost opaque on account of the black abdomen showing through; base coriaceous and punctate; apex smoky hyaline, just reaching tip of abdomen.

Sides of thorax pubescent; undersurface of thorax and head black; undersurface of abdomen deep brown with venter jet black; femora black; knees and tibiae ferruginous; tarsi and claws brown.

Length to tips of tegmina, 4.2 millimeters; width between humeral angles, 2.1.

MINDANAO, Zamboanga (*Baker*), 3 females.

Type (a female, Baker's duplicate No. 7643) in my collection; two paratypes (unnumbered) in Professor Baker's collection. One of these paratypes is from Davao, Mindanao.

Gargara rugonervosa sp. nov.

Small, robust, rough, black, veins of tegmina very prominent and nodulate; posterior process somewhat sinuate, extending just beyond internal angle of tegmen; tegmina uniform black with raised and tuberculate veins; legs black; tarsi light yellow.

Head wider than long, solid black, finely punctate, sparingly pubescent; upper (basal) margin sinuate; eyes black, not prominent; ocelli very small, pearly, nearer to the eyes than to each other and situated slightly above a line drawn through centers of eyes; clypeus strongly reflexed, extended well below inferior margin of face, tip smooth, rounded.

Pronotum rough, concolorous black, finely and densely punctate, sparingly pubescent; median carina strongly percurrent; metopidium nearly vertical; humeral angles prominent; posterior process somewhat sinuate, tip slightly decurved and extending just beyond internal angle of tegmen.

Tegmina dull black, base and veins shining black; base punctate; veins raised and decorated with large nodules.

Undersurface of body and all parts of legs black except tarsi, which are yellowish white.

Length to tips of tegmina, 3 millimeters; width between humeral angles, 1.5.

LUZON, Nueva Vizcaya, Imugan (*Baker*), 2 females and 1 male.

Type (a female) and paratype in Professor Baker's collection; allotype (Baker's duplicate No. 4907) in my collection.

Gargara irrorata sp. nov.

Small, female golden yellow marked with brown, male brown marked with darker brown; posterior process sinuate; tegmina opaque marked with brown and white; eyes strongly tinged with red; legs yellow.

Female (type).—Head dark brown, nearly black, convex, deflexed, very finely punctate, sparingly pubescent; eyes prominent, yellow with strong tinge of red; ocelli small, pearly, distinct, slightly nearer to the eyes than to each other and situated a little above a line passing through centers of eyes; clypeus strongly deflexed, black, tip extending far below inferior margin of face.

Pronotum bright yellow with brown markings on metopidium and apex of posterior process, very finely and closely punctate, sparingly pubescent; metopidium sloping, a brown mark on each side of median line and another above each eye; humeral angles prominent, blunt; median carina strongly percurrent and sharply elevated; posterior process strong, tectiform, decidedly sinuate, tip brown, extending just beyond internal angle of tegmen.

Tegmina opaque, base brownish yellow and punctate, rest of tegmen marked with alternate broad bands of brown and white, tip broad and very slightly hyaline.

Undersurface of body deep brown, slightly pubescent; legs yellow.

Length to tips of tegmina, 3.2 millimeters; width between humeral angles, 1.7.

Male.—Smaller, darker, more pubescent, general color cinnamon with markings of chocolate; arrangement of markings about the same as in female; tegmina black and punctate at base, markings of brown and white not so uniformly in bands as in female.

LUZON, Benguet, Baguio (*Baker*), 1 female and 1 male.

Type (a female) in Professor Baker's collection; allotype in my collection.

Genus **CRYPTASPIDIA** Stål

This genus can be best distinguished from *Gargara* by the fact that in *Cryptaspidia* the scutellum is always entirely concealed, while in *Gargara* it is always plainly visible at the basal sides of the posterior process.

Cryptaspidia tagalica Stål.

Add: *Habitat*.—BASILAN (*Baker*).

Cryptaspidia obtusiceps Stål.

I am determining a single specimen from Davao, Mindanao (*Baker's* duplicate No. 6472), as this species, which has not been recognized before. If it is not the identical form, it must be very close to it indeed; and it seems desirable to list it, at least tentatively, under this name.

It is a fine, large insect, 7 millimeters in length and 3.5 across the humeral angles (Stål's maximum measurements), shining black, coarsely punctate, very sparingly pubescent, the median carina almost obsolete, the posterior process strongly decurved and sharply tricarinate at the tip. The head is nearly flat, a character given by Stål as specific.

Cryptaspidia nigris sp. nov. Plate I, figs. 17 and 18.

Uniform shining black, except the apical two-thirds of the tegmina and the tarsi, which are ferruginous; coarsely punctured, sparingly pubescent; eyes reddish; posterior process strong, heavy, carinate, gradually acute, extending well beyond the internal angle of tegmen and almost to tip of abdomen; scutellum entirely concealed by pronotum; clypeus fused with genæ.

Head wider than long, shining black, impunctate, sparingly pubescent with golden hairs; basal (upper) margin of head sinuate; eyes large, projecting, reddish; ocelli distinct, pearly, slightly nearer to the eyes than to each other and situated slightly above a line drawn through centers of eyes; clypeus not clearly set off by sutures but apparently fused with genæ, tip arcuate, not projecting below the inferior margin of face but forming a part of the unbroken semicircle connecting the eyes as seen from a strictly cephalic view.

Pronotum shining black, coarsely punctured except in front, sparingly pubescent; metopidium sloping, smooth, impunctate, shining; median carina not percurrent; humeral angles prominent, rounded, posterior process gradually acute, wide at base, completely concealing scutellum, tip tricarinate, sharp, somewhat decurved, extending well beyond internal angle of tegmen and almost as far as tip of abdomen but not reaching tip of tegmina.

Tegmina smoky hyaline tinged with ferruginous except at base and basal third of costal margin, which are entirely coriaceous, jet black and punctured.

Legs and undersurface of body black; tarsi and claws light ferruginous.

Length to tips of tegmina, 6 millimeters; width between humeral angles, 3.

LUZON, Tayabas, Mount Banahao (*Baker*), a pair.

Type (female) in Professor Baker's collection; allotype in my collection.

With the foregoing revisions and additions, the check list of the family Membracidae, as represented in the Philippine Islands, is brought up to date with the synonymy indicated as follows:

- | | |
|---|--|
| 1. <i>Xanthosticta grisea</i> Buckt. | <i>Centrotus rupicapra</i> Fabr. |
| <i>Bolbonota grisea</i> Buckt. | <i>Centrotus taurus</i> Fabr. |
| 2. <i>Xanthosticta luzonica</i> Buckt. | <i>Membracis tricornis</i> Hardw. |
| <i>Bolbonota luzonica</i> Buckt. | <i>Centrotus terminalis</i> Walk. |
| 3. <i>Xanthosticta trivialis</i> Buckt. | <i>Centrotus vicarius</i> Walk. |
| <i>Bolbonota trivialis</i> Buckt. | <i>Leptocentrus gazella</i> Buckt. |
| 4. <i>Centrochares horrificus</i> West. | 18. <i>Leptocentrus leucaspis</i> Walk. |
| <i>Centrotus horrificus</i> West. | <i>Centrotus taurus</i> (in part: |
| <i>Pterygia horrificus</i> Walk. | error) Walk. |
| <i>Pterygia spinula</i> Buckt. | <i>Centrotus leucaspis</i> Walk. |
| 5. <i>Centrochares posticus</i> Buckt. | 19. <i>Leptocentrus reponens</i> Walk. |
| <i>Pterygia postica</i> Buckt. | <i>Centrotus reponens</i> Walk. |
| <i>Centrochares horrificus</i> (in part) Funkh. | <i>Centrotus antilope</i> Stål. |
| 6. <i>Centrochares bucktoni</i> Dist. | <i>Leptocentrus antilope</i> Stål. |
| <i>Pterygia postica</i> ♀ Buckt. | 20. <i>Centrotypus aduncus</i> Buckt. |
| 7. <i>Pyrgonota bifoliata</i> West. | <i>Leptocentrus aduncus</i> Buckt. |
| <i>Centrotus bifoliata</i> West. | 21. <i>Emphusis bakeri</i> Funkh. |
| <i>Smilia bifoliata</i> West. | 22. <i>Ibiceps erigens</i> Walk. |
| <i>Hypsauchenia westwoodi</i> Fairm. | <i>Centrotus erigens</i> Walk. |
| <i>Hypsauchenia bifoliata</i> Fairm. | <i>Sertorius erigens</i> Stål. |
| <i>Hypsauchenia bifasciata</i> Walk. | 23. <i>Ibiceps mounseyi</i> Dist. |
| 8. <i>Pyrgonota tumida</i> Stål. | 24. <i>Periaman brevifrons</i> Funkh. |
| 9. <i>Pyrgonota philippina</i> Stål. | 25. <i>Tricentrus convergens</i> Walk. |
| 10. <i>Pyrgonota bifurca</i> Stål. | <i>Centrotus convergens</i> Walk. |
| 11. <i>Pyrgonota semperi</i> Stål. | 26. <i>Tricentrus fairmairei</i> Stål. |
| 12. <i>Pyrgonota pinguiturris</i> Funkh. | <i>Centrotus fairmairei</i> Stål. |
| 13. <i>Pyrgonota longiturrus</i> Funkh. | <i>Terentius fairmairei</i> (error) Buckt. |
| 14. <i>Leptobelus dama</i> Germ. | <i>Taloipa tinctoria</i> Buckt. |
| <i>Centrotus dama</i> Germ. | 27. <i>Tricentrus capreolus</i> Walk. |
| 15. <i>Lobocentrus zonatus</i> Stål. | <i>Centrotus capreolus</i> Walk. |
| 16. <i>Dograna falco</i> Buckt. | 28. <i>Tricentrus pilinervosus</i> Funkh. |
| <i>Campylocentrus falco</i> Buckt. | 29. <i>Tricentrus plicatus</i> Funkh. |
| 17. <i>Leptocentrus taurus</i> Fabr. | 30. <i>Tricentrus attenuatus</i> Funkh. |
| <i>Cicada taurus</i> Linn. | 31. <i>Tricentrus orcus</i> Buckt. |
| <i>Membracis taurus</i> Fabr. | <i>Centrotus orcus</i> Buckt. |
| <i>Membracis rupicapra</i> Fabr. | 32. <i>Tricentrus robustus</i> Funkh. |
| | 33. <i>Tricentrus projectus</i> Dist. |
| | 34. <i>Tricentrus laticornis</i> Funkh. |

35. *Tricentrus fasciipennis* Funkh.
36. *Centrotus magellani* Fairm.
37. *Sipylus crassulus* Stål.
 Centrotus crassulus Stål.
38. *Sipylus dilatatus* Walk.
 Centrotus dilatatus Walk.
 Sipylus nodipennis Funkh.
39. *Sipylus acuticornis* Funkh.
40. *Centrotoscelus typus* Funkh.
41. *Centrotoscelus luteus* Funkh.
42. *Centrotoscelus concavus* Funkh.
43. *Ebhul carinatus* Funkh.
44. *Gargara luconica* Fairm.
 Membracis luconica Fairm.
 Enchenopa luconica Walk.
45. *Gargara pygmaea* Walk.
 Centrotus pygmaeus Walk.
46. *Gargara patruelis* Stål.
 Centrotus patruelis Stål.
47. *Gargara varicolor* Stål.
48. *Gargara pulchripennis* Stål.
49. *Gargara nigrofasciata* Stål.
50. *Gargara tuberculata* Funkh.
51. *Gargara luteipennis* Funkh.
52. *Gargara nitidipennis* Funkh.
53. *Gargara nigrocarinata* Funkh.
54. *Gargara brunnea* Funkh.
55. *Gargara trifoliata* Funkh.
56. *Gargara maculipennis* Funkh.
57. *Gargara pinguis* Funkh.
58. *Gargara rugonervosa* Funkh.
59. *Gargara irrorata* Funkh.
60. *Cryptaspidia pubera* Stål.
61. *Cryptaspidia tagalica* Stål.
62. *Cryptaspidia impressa* Stål.
63. *Cryptaspidia obtusiceps* Stål.
64. *Cryptaspidia nigris* Funkh.

ILLUSTRATION

PLATE I

- FIG. 1. *Pyrgonota longiturris* sp. nov., lateral outline.
2. *Pyrgonota longiturris* sp. nov., frontal outline.
3. *Tricentrus robustus* sp. nov., lateral outline.
4. *Tricentrus robustus* sp. nov., frontal outline.
5. *Tricentrus laticornis* sp. nov., dorsal outline.
6. *Tricentrus laticornis* sp. nov., frontal outline.
7. *Tricentrus fasciipennis* sp. nov., lateral outline.
8. *Tricentrus fasciipennis* sp. nov., frontal outline.
9. *Sipylus acuticornis* sp. nov., lateral outline.
10. *Sipylus acuticornis* sp. nov., frontal outline.
11. *Centrotoscelus concavus* sp. nov., lateral outline.
12. *Centrotoscelus concavus* sp. nov., frontal outline.
13. *Gargara maculipennis* sp. nov., lateral outline.
14. *Gargara maculipennis* sp. nov., frontal outline.
15. *Gargara pinguis* sp. nov., lateral outline.
16. *Gargara pinguis* sp. nov., frontal outline.
17. *Cryptaspidia nigris* sp. nov., lateral outline.
18. *Cryptaspidia nigris* sp. nov., frontal outline.

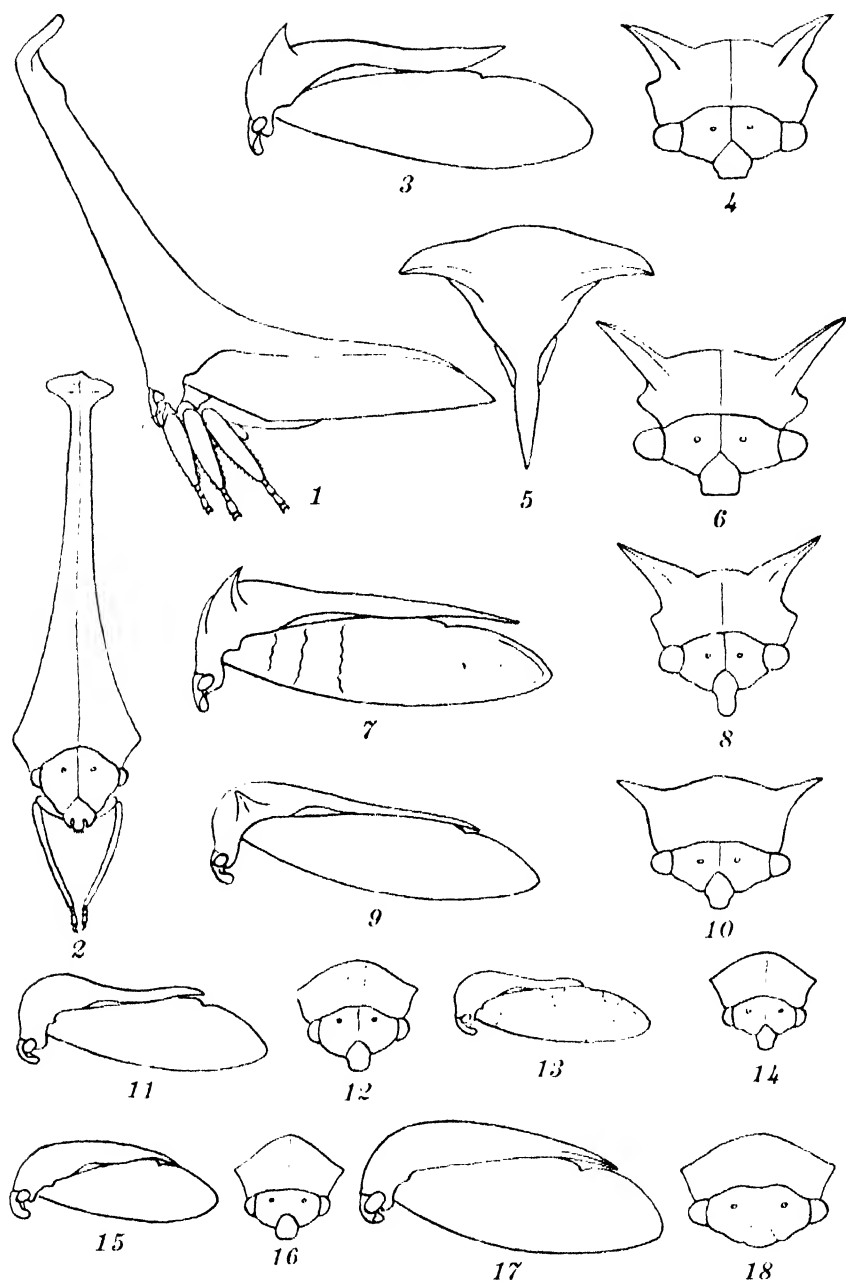


PLATE I. PHILIPPINE MEMBRACIDÆ.

REVIEWS

Leland Stanford Junior University Publications | university series | The Genera of Fishes | from Linnaeus to Cuvier, 1758-1833, seventy-five years, | with the accepted type of each. | A contribution to the stability of scientific nomenclature. | By | David Starr Jordan | assisted by | Barton Warren Evermann | Stanford University, California | published by the University | 1917 | Paper, 1-161. Price, \$1.

This publication considers the status of the genera of fishes that have been proposed in 164 publications by one hundred and odd authors, beginning with the tenth edition of the *Systema of Linnaeus*, 1758, and ending with the *Poissons Fossiles of Louis Agassiz*, 1833.

The object of the work has been the fixation of the generic types and, incidentally, the determination of the validity of the genera treated. Doctor Jordan very appropriately calls attention to the fact that "efforts to secure stability in nomenclature by fiat," using names more or less current, without serious regard to the law of priority, should be resisted. "To accept this plan would merely accentuate the confusion already existing and which has arisen through just such disregard of fundamental rules." The generic names, with their types, proposed by each author are listed under the respective publications. Notes on the status of publications, names, and synonyms, and much other information that will be of help to the Commission of the International Congress of Zoology when it undertakes to rule on the status of these various genera are given.

R. C. McG.

Population of the Philippine | Islands in 1916 | (Población de las Islas Filipinas en 1916) | Prepared under the direction of | Preparado bajo la dirección de | H. Otley Beyer | Assistant Professor of Anthropology, University of | the Philippines, and Curator, Bureau | of Science Museum. | [ornament] | Manila | Philippine Education Co., Inc. | 1917 | pp. 1-95. Full blue cloth, ₱1.60; paper, ₱1.10. Extra, if to be sent by mail, ₱0.15.

The book is printed in English and Spanish side by side. The Spanish translation is well rendered, and the text is unusually free from typographical errors.

In the introduction on page 17 the author states that there are several Tagalog dialects. The example he cites of the difference in the spoken Tagalog of Batangas from that of Bulacan

is merely a slight difference in the accent and it is perfectly understood by the Tagalogs of the other provinces.

Table I gives the different ethnographic groups arranged alphabetically. Other tables are given classifying the inhabitants according to religious belief and economic and social progress, and there is also a list of the different languages and dialects spoken in the Philippines.

Tables IX and X are of special local interest. Table IX gives the population of the 12 senatorial districts, and Table X, the population corresponding to each representative in the different provinces. The suggestion of the author of redistricting the Islands deserves careful consideration.

Part II gives the location, the number, customs, industry, etc., of the different ethnographic groups arranged alphabetically. This arrangement makes reference easy.

In view of the settled conditions now prevailing in those portions of the Philippines inhabited by the non-Christian population, I believe that the author's estimate of them is more accurate than those given in the census of 1903.

F. D. REYES.

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STUDIES IN PHILIPPINE HETEROPTERA, I

By E. BERGROTH

(*Jämsä, Finland*)

Since 1870, when Stål published his important paper *Hemiptera Insularum Philippinarum*, which includes three hundred twenty-one species of Heteroptera, only a small number of species belonging to this suborder has been added to the Philippine fauna in scattered papers by Lethierry, Reuter, Montandon, C. S. Banks, Distant, Breddin, Kirkaldy, Horváth, Martin, and myself. It is a great drawback that the Hemiptera collected by Prof. Carl Semper, on which Stål's work was based, bear no exact locality labels, not even the islands where they were found being indicated; we only know that most of his collections were made in Luzon, and that a smaller part of them is from Cebu and Mindanao.

During the last four years Prof. C. F. Baker has endeavored to bring together specimens of Philippine insects, and his efforts have proved a great success, of which the contents of this and many foreign journals give evidence. Professor Baker has kindly submitted to me for study his Philippine Heteroptera, excluding the Miridæ, Anthocoridæ, Nabididæ, and a few other smaller groups, which were entrusted to Doctor Poppius, who thus far has described many of the new Miridæ in the *Annales Historico-Naturales Musei Nationalis Hungarici*, the *Wiener Entomologische Zeitung*, and This Journal. A few of the new Pentatomidæ from Professor Baker's collection have been described by me in the *Annales de la Société Entomologique de Belgique* and the *Annals and Magazine of Natural History*. In the present paper, to be followed by others as soon as may be, I am giving descriptions principally of new Myodochidæ and

comments on little-known species of this family. The material of some myodochid genera rich in species (such as *Pamera*, etc.) still remains to be studied and will be reported upon in some future paper. The value of Professor Baker's collections is enhanced by the fact that the small forms have been by no means neglected, the most numerous and important additions to the Philippine heteropterous fauna belonging in fact to the small Myodochidæ and Tingidæ.

From the fact that Semper's collections were made during six years and from the material communicated by Professor Baker it is evident that the hemipterous fauna of the Philippine Islands is not nearly so rich and varied as that of New Guinea, Borneo, and Sumatra; and it must be borne in mind that the Hemiptera of these three islands are still to a great extent undescribed. When the extensive collections made by Biró and Loria in New Guinea and by Modigliani in Sumatra and the material stored in several museums have been fully worked out, the additions to the hemipterous fauna of these islands will be very considerable. Yet the Philippine fauna, judging from the Heteroptera alone, seems to be decidedly richer than that of Celebes and approximately equal to that of Java. When collections have been made in all the numerous islands composing the Philippine Archipelago, I suppose the number of Heteroptera until now found, principally by Semper and Baker, will be about trebled.

With the material now at hand I am under the impression that many species, especially among the endemic ones, are restricted to rather small areas. Certain species common in the Laguna district, near Manila, have not been found in the northern part of Luzon, and collections from Mindanao and Palawan are different both inter se and from those made in Luzon. Naturally, several species are more or less widely dispersed in the Indo-Malayan Region, and these convey the impression that the Philippine Archipelago as a whole has a hemipterous fauna more nearly related to that of Java than to that of Borneo and that many forms common to Borneo and Palawan have not reached Luzon. It is probable that the land bridge of yore, supposed to have united Borneo with Luzon, was disconnected between Palawan and Luzon long before the land connection between Mindanao and Java-Celebes had sunk. Among the Hemiptera very few forms point to the existence of an ancient land connection between Luzon and Formosa-China; and the few species previously known only from continental Asia (chiefly India and the Malay Peninsula), but later found

in the Philippines, have probably immigrated to the latter islands by way of Java or Borneo, where they are likely to be found.

Insect collections from the high mountains in the interior of Luzon, with their archaic mammalian fauna (showing Australian affinities) brought to light by Whitehead, and from the almost unknown, but probably no less interesting, mountain ranges in the interior of Mindanao are great desiderata; but such collections could be procured only by special expeditions involving great cost.

COREIDÆ

COREINÆ

HYGIARIA

Colpura denticollis sp. nov.

Oblong, brownish ochraceous, head, apical third and lateral borders of pronotum, connexivum, and male genital segment fuscous-black, corium dark castaneous, a vitta on each side of vertex touching the eye, a similar vitta on each side of underside of head, an oblong spot near middle of apical margin of corium, posterior border of connexival areas and apical callus of orificia luteous, membrane grayish ochraceous, the veins a little darker, venter with longitudinal blackish mottlings and in the anterior half with a blackish sublateral vitta in a line with the usual dull black spots of the last three segments; antennæ fuscous-black, more than apical half of last joint luteous; rostrum brownish ochraceous; legs fuscous, trochanters, extreme base of femora, a ring on basal half of tibiæ, and some mottlings to fore tibiæ and to hind femora luteous; punctate, the punctures each bearing a small, narrow yellowish scale, the punctation of the head very fine and superficial. Head slightly longer than broad, first joint of antennæ as long as head, second about one-third longer than first, bucculæ with the truncate anterior margin and the slightly rounded inferior margin forming a right angle, rostrum reaching middle of metasternum, first joint not quite reaching base of head, second as long as first, third one-third shorter than second and equal to fourth. Pronotum moderately declivous, not convex, without a distinct transverse impression, across the rather narrowly rounded, scarcely prominent, humeral angles, not quite two and a half times broader than at apex and about one-third broader than the length of the lateral margin, the apical angles produced forward in a triangular tooth about as long as half the breadth of the eye, the lateral margins almost straight, only behind the middle broadly and very

slightly sinuate, narrowly depressed, still narrower toward the humeral angles but also visible throughout from above, the basal margin broadly and very slightly sinuate. Scutellum perfectly plane. Elytra reaching apex of abdomen. Abdomen with the apical angles of the fifth segment very slightly prominent, venter not sulcated, male genital segment impressed at the middle of the apical margin, which is rounded, with a shallow arcuate sinuosity in the center (much as in *C. hebeticolis* Bredd.). Femora beneath with a few minute teeth in the apical half.

Length, male, 10.5 millimeters.

LUZON, Laguna, Mount Banahao.

Of one antenna only the first two joints remain. The other antenna is abnormally developed, the second and third joints being fused into one, which is thicker and somewhat longer than the normal second joint; the robust fourth joint is about half the length of the first, but is possibly somewhat different in normal antennæ.

I place this species provisionally in Breddin's subgenus *Microcolpura* near *Colpura tuberculicollis* Bredd., from which it differs in the structure of the male genital segment and in several other details. However, as the single entire antenna is abnormal and the female is unknown, it is not impossible that it will prove to belong to *Sciophyrus* Stål or to *Xanthocolpura* Bredd.¹ It agrees well with *Vittorius* Dist. in all essential points, but whether *Vittorius* is a valid genus is impossible to know as Distant, although he had a female specimen before him, has not described the genital characters of this sex. In this difficult group it is absolutely necessary to know the genital characters.²

Professor Baker has found *Colpura obscuricornis* Stål on Mount Maquiling and *C. maculipes* Stål on this mountain and on Mount Banahao. Both these species are very variable in the color of the legs, which are sometimes almost entirely fuscous.

Caracolpura Bredd. (type, *C. planiceps* Bredd.), which Breddin regarded as a subgenus of *Colpura*, seems to me to be generically quite distinct from it by the structure of the head, which is broader than long, quite plane above, and distinctly narrowed

¹ In my supplement to Lethierry and Severin's Catalogue of the Co-reidæ I have indicated *Xanthocolpura venosa* Bredd. as described from Borneo, but its habitat is Balabac Island, about 32 kilometers (about 20 miles) south of Palawan, which politically belongs to the Philippines.

² Since this remark was written Kiritchenko has shown, after examination of specimens of *Vittorius adpersus* Dist., that *Vittorius* Dist. is a straight synonym of *Colpura* Bergr.

from the eyes to the apex of the antenniferous tubercles. It forms a transition to the genus *Agathyrna* Stål.

***Homalocolpura sorbax* sp. nov.**

Oblong-ovate, shiny beneath (including the ventral glandular spots), much less so above, black, corium fuscous-black, anterior end of bucculæ, apex of scutellum, a small spot near middle of apical margin of corium, and apical margin of fourth and fifth ventral segments luteous, an interiorly abbreviated apical fascia to the connexival areas above and beneath fulvous, membrane black, orificia brownish; antennæ fuscous-black, third joint a little paler, base of third and the whole fourth joint luteous; rostrum luteous; legs piceous-black, coxæ and tibiæ somewhat paler, trochanters, base of femora, and the tarsi luteous, last joint of the latter infuscated; moderately densely punctate, excluding head, the subapical pronotal transverse callosity, and the connexivum above and beneath; the whole body clothed with a very short upright pile visible only if the insect is viewed in profile, but somewhat longer and semierect on the venter, the short hairs on the postocular tubercles and on the lateral margins of the pronotum stiffer and visible also from above. Head one-half longer than broad and almost as long as pronotum, transversely and longitudinally convex, sparsely and finely punctate, slightly widening from eyes to apex of antenniferous tubercles, this distance shorter than anteantennal part of head, eyes larger and more prominent than the postocular tubercles, antennæ half the length of the body, rather slender, first joint about half the length of head, passing apex of head by less than half its length, second joint a little longer than first and a little shorter than third, fourth longer than third, subcylindrical, rostrum reaching a little beyond apex of abdomen. Pronotum a little declivous, about one-half broader than long, at apex a little more than half the basal width, near apex with a rather strongly convex, anteriorly almost perpendicular, transverse callosity almost reaching the lateral margins, terminated behind by a transverse impression and in the middle of its posterior half subquadrately impressed, the apical angles right-angled, projecting a little forward, the lateral margins straight, very narrowly carinate, the basal margin somewhat sinuated in front of the scutellum, which is slightly convex in its basal half. Elytra of female reaching base of first genital segment. Abdomen with the apical angles of the fifth segment very slightly prominent, venter deeply grooved from its base to apex of fourth segment, basal plica of

sixth female segment slightly passing the center of the segment, obtuse-angled at apex. Femora beneath with a longitudinal groove terminated on each side by a row of spines, which in the front femora is extended to the base, but in the mid and posterior femora only reaches the middle, the spines gradually decreasing in size toward the base.

Length, female, 11.5 millimeters; humeral width, 3.5.

LUZON, Laguna, Mount Banahao.

This species is nearest to *H. sugax* Bredd., but is broader and is readily distinguished by several structural characters. The genus *Homalocolpura* Bredd. is new to the Philippine Islands.

ALYDINÆ

LEPTOCORIXARIA *

Genus *DICORYMBUS* novum

Body oblong, about or little more than four times longer than broad. Head horizontal, anteocular part between eyes and antennæ and postocular part parallel-sided, a small fovea in front of each ocellus and a short median longitudinal impression somewhat behind clypeus, the robust convex juga shortly conically produced beyond clypeus, their inner margins almost meeting before clypeus, then strongly divaricate, forming a right-angled or obtuse-angled sinuosity, apical half of clypeus vertical, strongly widening at apex, eyes moderately prominent, seen from above longer than broad, ocelli placed almost on a line with posterior angles of eyes and as far from them as from one another, bucculæ rather high, their anterior margin subtruncate, the inferior apical angle subdentate, antennæ about as long as the body, first joint somewhat shorter than head and pronotum together, cylindrical but elongately clavate at apex, second and third joints linear, third shorter than second, fourth much the shortest, rostrum reaching or a little passing base of venter, first joint reaching base of head, second slightly shorter than first and much shorter than third and fourth together, fourth somewhat longer than third. Pronotum slightly sloping from the

* With the Leptocorixaria I unite Stål's division Microlytraria. Stål separated them on account of the somewhat differently constructed rostrum; but this character is of little importance and not constant, there being intermediate forms that might be referred as well to one as to the other of these divisions. Distant (Fauna Brit. India, Rhynch., 1, 405) has removed the division Stenocephalaria from the subfamily Alydinæ, regarding it as a division of the Pseudophloeinæ, but he gives no reasons for this absurd innovation.

interhumeral line to a little beyond middle, then almost horizontal, a little broader than long, at apex little more than half the humeral width, the lateral angles armed with a tooth or short spine, the straight posterolateral margins forming an obtuse angle with the truncate basal margin. Scutellum longer than broad, acute at apex. Elytra a little shorter than abdomen, commissure of clavus a little shorter than scutellum, apical margin of corium broadly and gently rounded toward the inner apical angle, the outer apical part moderately produced, reaching somewhat beyond middle of membrane. Mesosternum longitudinally grooved in the middle. Abdomen in the male with the last dorsal segment roundly produced backward and with a sinuosity between the projecting part and the last connexival segment, the apical angle of which is obtuse; in the female with the last dorsal segment broadly and slightly sinuate posteriorly, apical angle of last connexival segment produced, subacute at apex; spiracles placed much nearer to the basal than to the apical margin; sixth female ventral segment without a basal plica, but with a percurrent median fissure, the apical margin trisinate, the median sinuosity rather deep and subacutely angular, the lateral ones broad and shallow; the two female dorsal genital segments broadly and slightly sinuate at apex. Legs moderately short, femora unarmed, the front pair, when stretched forward, passing apex of head by less than half the length, the hind pair about reaching middle of fifth ventral segment, all tibiæ sulcated above, first joint of hind tarsi somewhat longer than the other two together.

A rather isolated genus coming nearest to *Mutusca* Stål; but abundantly distinct by the much broader and more robust body; quite differently constructed juga, antennæ, bucculæ, pronotum, and sixth female ventral segment; more separated and more forwardly placed ocelli; longer rostrum and legs; less produced outer apical part of corium; different position of the spiracles; sulcated tibiæ; and shorter metatarsus of hind legs.

Type of the genus, *Dicorymbus nigridens* sp. nov.

Dicorymbus nigridens sp. nov.

Lurid ochraceous, rather coarsely and densely brown-punctured, median part of mesosternum impunctate with two narrow punctate vittæ, the tooth of the humeral angles black, apex of scutellum and a spot at apical margin of corium in the cell near the inner apical angle whitish and impunctate, a spot at apical angles of connexival segments (much larger on the last segment), two spots at base and one at apical angles of first female dorsal genital segment (sometimes confluent), and

second female dorsal genital segment, at least at the sides, fuscous-black, venter often of a dark greenish hue and probably always green in living specimens; antennæ, rostrum, and legs concolorous with the body, the first three antennal joints and femora densely and very finely dotted with brown, apex of second and third antennal joints fuscous, fourth joint whitish with a greenish tint (probably pale green in the live insect), tibiæ with three narrow fuscous annulations, the nethermost of which is sometimes obliterated. Head slightly longer than broad, second joint of antennæ subequal in length to first, fourth half the length of third and a little narrower than the clavate part of the first. Pronotum a little longer than head, lateral margins almost straight, sinuate only before the humeral tooth. Abdomen with the apical angles of the fifth segment a little prominent, male genital segment trituberculate at apex, the median tubercle larger and more prominent than the lateral ones, the margin arcuately sinuate on each side between the tubercles.

Length, male, 14.5 millimeters; female, 14.8 to 16.2.

LUZON, Laguna, Mount Maquiling and Paete.

This species does not seem to be rare in the first-named locality.

Genus **XENOCERAEA** novum

Body elongate, gradually widening backward to beyond middle of abdomen. Head horizontal, anteocular part between eyes and antennæ and postocular part parallel-sided, a short longitudinal impression behind clypeus, the slender juga longly spinously produced beyond clypeus, eyes slightly prominent, seen from above much longer than broad, the small ocelli placed a little behind the level of the posterior angles of the eyes and as far from them as from one another, bucculæ rather short and low, somewhat longer than high, triangular, their anterior and inferior margins straight, antennæ somewhat shorter than the body, first joint a little longer than the head, robust, triquetrous, turning one edge downward, one upward, and one inward, second joint subcylindrical, but with the apical third compressedly clavate, third more slender and much shorter than second, with the apex incrassate and obliquely truncate, fourth much the shortest, fusiform; rostrum reaching middle of metasternum, first joint not reaching base of head, second a little shorter than first and much shorter than the last two together, fourth somewhat longer than third and subequal to second. Pronotum slightly sloping, somewhat longer than broad,

across the humeri at least one-third broader than at apex, apical margin arcuately sinuate, apical angles dentately projecting forward, lateral margins straight, humeral angles not prominent, posterolateral margins a little longer than the slightly subsinuate basal margin with which they form an obtuse angle. Scutellum narrow, longer than broad. Elytra somewhat shorter than abdomen, commissure of clavus much longer than scutellum, apical margin of corium broadly rounded in its interior half, not sinuate toward the apical angle, which reaches about middle of membrane and is narrowly rounded, veins of membrane furcate and united by cross veins here and there. Meso- and metasternum longitudinally grooved in the middle; apical angles of metapleura acute. Abdomen in the female with the apical margin of the last segment straight, the apical angles somewhat produced backward but almost right-angled; spiracles placed before middle of segments; sixth ventral segment with a short triangular basal plica and a fissure behind the plica, the apical margin angularly incised behind the fissure. Legs short, femora unarmed, the front pair when stretched forward reaching a little beyond apex of head, the hind pair slightly passing middle of fourth ventral segment, tibiæ (particularly the fore and hind ones) shorter than femora, not distinctly sulcate above, first joint of hind tarsi as long as the other two together.

Somewhat related to the preceding genus, but with quite differently constructed juga, antennæ, and pronotum, longer claval commissure, less produced apical angle of corium, and shorter legs.

Type of the genus, *Xenoceraea bakeri* sp. nov.

Xenoceraea bakeri sp. nov.

Dull testaceous (including antennæ, rostrum, and legs), last antennal joint and a small spot at humeral angles of pronotum fuscous, extreme apex of clavi, apical margin of acetabula, a small spot on propleura and mesopleura, a few small interior spots on metapleura, apical angles of abdominal segments, a diffuse subapical fascia to last dorsal segment, and irregular speckles on the sides of venter arranged in two or three longitudinal rows blackish; punctate with pale brown, very finely so on head and pronotal cicatricial areas; coarsely, thickly, and seriatly punctate on corium and clavus; puncturation of connexivum irregular and fuscous. Head much longer than broad, second antennal joint a little longer than first, fourth one-third the length of third. Pronotum in the middle slightly shorter

than head. Elytra (of female) reaching a little beyond base of last segment. Second dorsal genital segment of female obtuse-angularly sinuate at apex.

Length, female, 14 to 14.5 millimeters.

MINDANAO, Iligan and Davao.

Marcus formicinus sp. nov.

Black (including antennæ, rostrum, and legs); base of first and a subbasal annulation of fourth antennal joint, the depressed lateral parts of the pronotal basal margin, a basal vitta, an antemedian subtriangular spot, a postmedian fascia (at the base of the narrow produced part) and the interior half of apical margin of corium, posterior margin of mesopleura, a triangular spot occupying posterior angle of metapleura, a spot on middle acetabula, an oblong lateral spot at base of third, and a much smaller subquadrate lateral spot at base of fourth and fifth abdominal segments white; a lateral spot on head at inferior margin of eyes, a longitudinal line between ocelli, a basal streak to clavus, and apical border of prosternum obscurely luteous; membrane fuscous, tinted with violet, somewhat less than its apical half hyaline, trochanters dark ferruginous; head, spines of anterior pronotal lobe, posterior pronotal lobe (including spines), scutellar spine, pleura, the first three antennal joints, underside of rostrum, and legs sparsely, erectly, and rather longly palely pilose. Head longer than pronotum and twice longer than broad (excluding the strongly prominent eyes), impunctate, lateral margins bluntly carinate between eyes and antenniferous tubercles, slightly rounded between eyes and the short subparallel neck, anteocular part twice longer than postocular part, distance between antennæ and apex of clypeus twice longer than that between antennæ and eyes, first joint of antennæ one-third shorter than head, second a little longer than first and third, which are subequal in length, fourth slightly longer than second and third combined, rostrum reaching a little beyond base of venter, first joint as long as head, second equal in length to first and nearly twice the length of the last two joints united, fourth three times longer than third. Pronotum (excluding humeral spines) slightly narrower than head (including eyes) and almost as broad as long, anterior lobe impunctate apart from scattered points near the apical margin, with two stout and rather long, divergent, conical, apically attenuated spines; posterior lobe twice longer than anterior lobe, rather thickly and coarsely punctate, basal margin depressed in front of elytra, humeral spines as long as the anterior spines, directed obliquely

outward and upward and slightly recurved. Scutellum remotely punctate, at apex with an upright spine, which is considerably longer than the pronotal spines. Corium seriatly punctate, its inner apical area membranous, the narrow, produced, outer apical part reaching but little beyond middle of membrane, the latter with very distinct veins arising from a basal vein, which is almost contiguous to the apical margin of the corium. Pleura very sparingly punctured, except the thickly and coarsely punctate posterior half of the propleura. Abdomen oblong-oval, but with the first two segments narrower and subparallel, venter with an extremely short, dusty, pale pubescence. Legs slender, hind femora a little surpassing apex of abdomen.

Length, male, 14 millimeters.

LUZON, Laguna, Mount Maquilung.

In some characters this species is intermediate between *M. generosus* Stål and *quinquespinus* Stål, but is very distinct from both, and by the less-produced apical part of the corium it forms a transition to the genus *Dulichius*. It much resembles a big ant and this resemblance is probably still more striking in the living insect. When a monograph of this group is undertaken a new genus will possibly be required for this species and another for *M. quinquespinus*, as they differ in several important points from the type of the genus as well as inter se.

MYODOCHIDÆ

ASTACOPINÆ

Astacops caviceps sp. nov.

Fulvous; clypeus (at least at apex), a broad median vitta to vertex (posteriorly scarcely reaching beyond the ocelli and sometimes entirely wanting), posterior lobe of pronotum, and corium (including clavus) black, with a slight greenish luster; membrane fuscous, antennæ black, base of first joint fulvous, rostrum piceous, legs testaceous, the hind pair (or at least its tibiæ and tarsi) more or less infuscated. Head a little broader than humeral width of pronotum, vertex with a longitudinal median groove as broad as the space between the ocelli, ocular peduncles directed outward and slightly upward and backward, ocelli a little more distant from the eyes than from each other, second and third antennal joints subequal in length, fourth one-third longer than third, rostrum reaching or a little passing hind coxæ. Pronotum declivous, a little narrowed from the base to apex, the transverse impression well marked, lateral margins a little sinuate, anterior lobe with two strongly divergent levigate

lines beginning not far from each other at the base of the lobe and running to the apical angles, posterior lobe about two times longer than anterior lobe, rather coarsely and sparsely punctate and with a transverse impression at the middle of its anterior margin. Scutellum with a T-shaped elevation. Elytra a little passing apex of abdomen; corium and clavus rugulose, clothed with a short, sericeous, whitish pubescence. Abdomen as broad as the closed elytra, subparallel from its base to apex of fourth segment, beneath in the middle rather longly, erectly pilose, especially in its apical half, male genital segment transversely impressed before the rounded apical margin. First joint of hind tarsi two-thirds longer than the other joints together.

Length (exclusive of membrane), male, 6 to 6.3 millimeters.

LUZON, Los Baños, Mount Maquiling; Tayabas, Malinao.

Somewhat related to *A. militaris* Dist. and *A. gibbicollis* Horv. and intermediate in size between these two species; it differs from both by the much longer metatarsus of the hind legs and by the color markings, from *gibbicollis* also by shorter and differently sculptured anterior lobe and less densely punctate posterior lobe of the pronotum.

Astacops lividiventris sp. nov.

Black, finely palely pubescent, head (excluding the black clypeus and a board median fuscous vitta to vertex), a more or less distinct transverse spot on each side of the pronotal apical margin near the angles, and pectus rusty testaceous; abdomen pale livid subglaucous, membrane fuscous, antennæ fuscous-black, rostrum piceous, legs pale testaceous, tibiæ and tarsi infuscated. Head slightly broader than humeral width of pronotum, vertex with a longitudinal median groove much narrower than the fuscous vitta in which it is placed, this groove terminated on each side by a blunt elevation, ocular peduncles short, directed outward, ocelli a little more distant from each other than from the eyes, second and third joints of antennæ equal in length, fourth conspicuously longer than third, rostrum reaching hind coxæ. Pronotum a little declivous (anterior lobe very slightly so), a little narrowed from base to apex, the transverse impression rather shallow, lateral margins very slightly sinuate, anterior lobe with a curved transverse callosity ending at the apical margin near the angles, the callosity provided with an impressed line interrupted in the middle, posterior lobe about two and a half times longer than the anterior one, sparsely but rather coarsely punctate, especially near the middle. Scutellum with a T-shaped carination. Elytra a little

passing apex of abdomen, corium and clavus finely rugulose. Abdomen as broad as the closed elytra, parallel from its base to beyond the middle. First joint of hind tarsi slightly longer than the other joints together.

Length (exclusive of membrane), male, 4 millimeters; female, 4.6.

PALAWAN, Puerto Princesa.

Allied to *A. borneensis* Dist., but smaller, with more separated ocelli, shorter anterior pronotal lobe, and different coloring, especially of the underside and the legs.

Astacops fulviventris sp. nov.

Black, finely palely pubescent, membrane fuscous, anterior margin of prosternum and margins of all acetabula grayish white, metasternal orificia and abdomen fulvous; antennæ, rostrum, and legs black; trochanters testaceous. Head very slightly narrower than humeral width of pronotum, vertex with a longitudinal median groove much narrower than the space between the ocelli and terminated on each side by a small oblong tubercle, ocular peduncles short, directed outward, ocelli very slightly more distant from each other than from the eyes, antennæ constructed as in *A. lividiventris*, rostrum about reaching hind coxæ. Pronotum moderately declivous, with both lobes in the same plane, somewhat narrowed from base to apex, the transverse impression rather shallow, lateral margins a little sinuate in the middle, anterior lobe with two impressed, strongly divergent, levigate lines beginning not far from each other near the base of the lobe and running toward the apical angles, but not reaching them, posterior lobe three times longer than the anterior one, sparsely but rather coarsely punctate. Scutellum, elytra, abdomen, and metatarsus of hind legs as in *A. lividiventris*.

Length (exclusive of membrane), female, 4.8 to 4.9 millimeters.

LUZON, Laguna, Los Baños.

Allied to the preceding species, but with somewhat less separated ocelli, differently constructed pronotum, and different coloration, especially of the underside and the legs.

Astacops ruficollis Banks.

Scopias ruficollis BANKS, Phil. Journ. Sci., Sec. A (1909), 4, 571, Pl. II, fig. 2.

LUZON, Tayabas, Malinao.

This species, originally described from Palawan, has the head distinctly broader than base of pronotum, vertex longitudinally impressed in the middle, ocular peduncles directed outward and

a little upward, ocelli two-thirds more distant from eyes than from each other, pronotum declivous (anterior lobe less so), very slightly narrowed from base to apex with sinuate lateral margins and well-marked transverse impression, its posterior lobe one-half longer than the anterior one, coarsely and thickly punctate, abdomen parallel from its base to beyond middle, and first joint of hind tarsi scarcely longer than the other two joints together. Banks describes the meso- and metapleura as coralline, but they are fuscous, whereas the propleura are red, quite as should be expected, species with a pale pronotum also having pale propleura.

The genera *Astacops* Boisd. and *Scopiastes* Stål were united by Breddin, but Horváth⁴ has recently again separated them, on the basis of characters other than those used by Stål. They could in fact be kept apart, should the characters relied on by Horváth really hold good, but this is not the case. Boisduval founded his genus on two new species, *australis* and *doryca*. The former, which was fixed as type by Distant, does not seem to have been rediscovered since it was described, but I suspect it is a *Scopiastes* (in Horváth's sense). *Astacops doryca* is unknown to me, but as Stål says of it "caput basi thoracis vix angustius," it seems also to be a *Scopiastes* (Horv.). Since the founding of the genus numerous other species have been described, and some of them have been placed in *Astacops*, some in *Scopiastes*; but among them there are several species that are manifestly intermediate between these genera, either as understood by Stål or by Horváth. As all must agree that the characters given by Stål cannot be used to separate them, we have in the following examples to take into account only the characters given by Horváth:

Astacops gracilis Bredd.: Head as in *Scopiastes*, tarsi as in *Astacops*, pronotum intermediate.

Astacops laticeps Bredd. and *lividiventris* Bergr.: Head, form of pronotum, and tarsi as in *Scopiastes*, mutual length of pronotal lobes as in *Astacops*.

Astacops caviceps Bergr.: Head and pronotum as in *Scopiastes*, tarsi as in *Astacops*.

Astacops fulviventris Bergr.: Head and tarsi as in *Scopiastes*, mutual length of pronotal lobes as in *Astacops*, form of pronotum intermediate.

The genus *Acthalotus* Stål was separated from *Astacops* and *Scopiastes* by the character "ocellis inter se quam ab oculis

⁴ Ann. Mus. Nat. Hung. (1914), 628.

circiter duplo longius remotis," but the distance between the ocelli was probably somewhat exaggerated, as Stål in his original description of the type says that the ocelli are "inter se quam ab oculis paullo longius remoti." At any rate none of the species of *Aethalotus* described since have the ocelli so widely separated as in Stål's generic diagnosis they are said to be in the typical species. *Astacops* (*Abgarus**) *typica* Dist. is said to have the ocelli "between the eyes and much nearer to their insertion than to each other," according to which character it would be an *Aethalotus*, but from the figure it is clear that the ocelli are much more separated from the eyes than from each other and that Distant has regarded the peduncle bearing the eye as belonging to the eye itself! It is apparently owing to the same mistake that he placed his species *borneensis* in *Aethalotus*, although the ocelli, as the figure shows, are more remote from the eyes than from each other. *Aethalotus* could be separated from *Astacops* (inclusive of *Scopiastes*) solely by the distance between the ocelli being greater than that between them and the eyes, but the species in which these distances are equal would in any case be intermediate forms. The distance between the ocelli as compared with that between them and the eyes generally depends on the length of the ocular peduncle in the different species and is a purely specific character. Owing to the manifest connecting links, these three "genera" must, in my opinion, be united. By their fusion *A. nigripes* Dist. becomes a preoccupied name; I propose for this species the name *A. melampus*.

***Aspilocoryphus mendicus* Fabr.**

LUZON, Benguet, Baguio.

This and the following species were hitherto known only from India.

***Lygaeosoma bipunctata* Dall.**

LUZON, Benguet, Baguio.

On this and two other species Reuter founded the genus *Melanotelus*, but there are no reliable characters separating it from *Lygaeosoma*. In many genera of this subfamily the posterior margin of the metapleura is more or less oblique and

* The genus *Abgarus* Dist. was founded on a fictitious character, brought on by an injury inflicted on the type, the head having been forced out of its natural position so that the neck only touches the upper apical margin of the prothorax; this is quite obvious from the profile-figure of the specimen.

more or less straight or sinuate, and the posterior metapleural angle more or less rounded or angular even in the same species.

CYMINÆ

Genus **RHIOBLA** novum

Head subequilaterally triangular, clypeus longer than juga, vertex somewhat less than three times broader than an eye, ocelli over two times more distant from one another than from eyes, antenniferous tubercles truncate at apex, unarmed, first joint of antennæ much shorter than any of the other joints, second and third joints slender and linear, fourth a little longer than third, bucculæ low but percurrent, only their shortly rounded anterior ends visible from the side, the remaining parts of them, when viewed from the side, hidden by an oblong longitudinal callosity placed between the bucculæ and the eyes, rostrum passing hind coxæ, first joint extended beyond anterior margin of prosternum. Pronotum three times broader across the humeri than at apex; laterally slightly constricted before the middle, divided into two lobes by a transverse impression, the anterior lobe with rounded sides but with a depressed (though transversely convex) parallel-sided apical collar, posterior part of the lobe with a transverse callosity, which immediately within the lateral margins is curved backward and then inward, forming a hook, the posterior lobe two times as long as the anterior one, with straight sides and rounded humeral angles, the broadly rounded basal margin narrowly depressed with the extreme margin a little elevated, pronotal lateral margins bluntly carinate, the carina forming a continuation of the narrowly elevated basal margin, suddenly discontinued a little behind the apical angles, leaving the sides of the collar vertically rounded, immarginate. Scutellum a little broader than long, near the base with a transverse, obtuse-angled, linear callosity emitting a ridge from its middle to the apex. Elytra hyaline, their exterior margins parallel near the base, then a little roundly ampliate, clavus with three rows of punctures, the outermost row placed in an impressed line, the commissure half the length of the scutellum, corium impunctate excepting two rows of punctures, one near the claval suture continued more or less distinctly along the apical margin, the other at the outer margin of the radial vein, the latter row only in its apical part visible from above, the remainder of it visible only from the side, radial vein gradually strongly deviating from costal margin, joining apical margin near or not far from its

middle, the radial sector starting from the radius far before its middle, then running parallel to it, ending abruptly a little behind middle of corium, costal border somewhat reflected, apical margin straight, as long as claval suture. Orificia directed obliquely outward and forward, oval, callosely margined, and subauriculate. Posterior border of the metapleura laminately depressed, strongly widening outward, apical angle more or less rounded. Abdomen more or less strongly and transversely convex beneath, somewhat compressed, much more so in the female, a little (male), or somewhat more (female), passing apical angle of corium; fourth and fifth ventral segments with two dark sublateral glandular spots, one behind the other; last male dorsal segment roundly produced in the middle. Fore femora not incrassated, unarmed. First joint of hind tarsi a little longer than the others united.

Type of the genus, *Rhiobia praeceps* sp. nov.

This genus is allied to *Ischnorhynchus* Fieb., from which it differs principally by the structure of the pronotum and scutellum.

In the normal position of the female ventral segments in this and some other genera the middle of the fourth and fifth segments is not visible, being drawn in under the third segment so that the sixth reaches the apical margin of the third and is extended forward beyond the middle of the venter. But the female in these genera is capable of pushing out the fourth and fifth segments, and if it happens to die at the moment they are pushed out (as is the case in one of the females before me), these segments remain fully visible also in the middle, and the sixth segment takes a much more acclivous position, not extending to the middle of the venter. The characters taken from the length and position of the last three female ventral segments ought, therefore, to be used with some caution.

Rhiobia praeceps sp. nov.

Glabrous, dull, stramineous, the punctation fuscous, meso- and metapleura and venter, and sometimes pronotum, more or less tinged with ferruginous, a small humeral spot and a small basal median spot to pronotum fuscous, corium almost colorless but a subbasal spot, a rather large, triangular, anteriorly transversely truncate spot occupying the apical angle (except the extreme apex), the posterior part of the radial vein and the apical margin (except a rather broad breach in the interior half) dark brown, the interior margin and commissure of the clavus and the median fissure of the sixth female ventral segment blackish, a

fuliginous ventral vitta on each side extended from middle of third to apical margin of fifth segment, halfway between the middle and the lateral margins, the laminately depressed posterior border of the metapleura, the apical border of the last male dorsal segment and often also a subquadrate lateral spot to the ventral segments 2 to 5 and the sides of the last ventral segments whitish; tergum of abdomen with more or less distinct fasciate or macular fuscous markings or suffused with this color, the last segment unicolorous except a fuscous basal spot; antennæ and rostrum pale testaceous, second and third antennal joints at apex and fourth at base (narrowly) and at apex (broadly) dark fuscous, last two rostral joints piceous; legs stramineous, and annulation before apex of femora and extreme apex of tibiæ and of tarsal joints fuscous. Head strongly declivous (45°), immersed to the eyes, irregularly punctulate above, clypeus impunctate, the callosity between the bucculæ and eyes oblique, first joint of antennæ reaching a little beyond apex of head, second somewhat more than twice the length of first and as long as the distance between the inner margins of the eyes, third subequal to second or a little shorter, fourth sublinear but conspicuously thicker than the two preceding ones and even slightly thicker than the first, rostrum a little surpassing base of venter, first joint not reaching middle of prosternum. Pronotum rather densely punctate, the transverse callosity and three more or less distinct vittæ on each side of the posterior lobe remotely punctate; the apical margin of the collar, the lateral hooked parts of the transverse callosity, and a median line to the posterior lobe impunctate; the posterior lobe longitudinally convex, its anterior part and the anterior lobe (except the collar) lying in the same strongly declivous plane as the head, the collar much less slanting, forming an angle with the posterior part of the anterior lobe. Scutellum thickly punctate, the almost T-shaped callosity impunctate. Pectus rather thickly punctate; anterior margin of prosternum, a spot on propleuræ and mesopleuræ, the posterior laminate border of the metapleuræ, and the acetabula impunctate. Abdomen impunctate; male genital segment near the base with a small tubercle and behind this with a narrow, curved, transverse impression. First joint of hind tarsi scarcely longer than the other two together.

Length, male, 3.5 millimeters, inclusive of membrane, 4.5; female, 3.9 to 4.5, inclusive of membrane, 4.5 to 5.2.

LUZON, Laguna, Mount Maquiling and Mount Banahao.

Rhiobia longirostris sp. nov.

Glabrous, dull, coloration as in the preceding species with the following exceptions: The small fuscous median basal spot to pronotum and subbasal spot to corium wanting, the radial vein and its sector almost entirely fuscous, the anterior margin of the brown triangular spot at apical angle of corium oblique, the last two dorsal segments pale with a median fuscous vitta and brownish sides, venter brown with the apical margin of segments 3 to 5 and the whole sixth segment pale; antennæ pale testaceous, the last joint dark fuscous, rostrum colored as in *R. praeceps*, legs stramineous, fore and middle femora finely dotted with brown, an annulation before apex of hind femora and extreme apex of all tibiæ brown, last tarsal joint black; punctuation as in *R. praeceps*, but the impunctate spot on the propleura and the mesopleura lacking. Head porrect, not declivous, but with the upper side longitudinally a little convex, the callosity between the bucculæ and eyes straight, longitudinal, first joint of antennæ not quite reaching apex of head, second four times longer than first and one-half longer than width of head across eyes, third subequal to second, fourth linear, distinctly thicker than the two preceding ones, but not thicker than the first, rostrum extended far beyond the center of the venter, its first joint reaching middle of prosternum. Pronotum with the posterior lobe longitudinally somewhat convex, the anterior part of the lobe moderately declivous, the anterior lobe, including the collar, very slightly declivous. Abdomen impunctate, beneath less convex and compressed than in *R. praeceps*. First joint of hind tarsi a little longer than the other two together.

Length, female, 5 millimeters, inclusive of membrane, 6.

LUZON, Laguna, Mount Banahao.

Differs from the preceding species (apart from other characters) by the much less declivous head and pronotum, the shorter first antennal joint, and the much longer rostrum; but it is unquestionably congeneric.

Genus RHIOPHILA novum

Body oval, its greatest height on a line with the pronotal humeral angles, from which point it is strongly, convexly declivous to the apex of the head and distinctly though much less sloping to the apex of the abdomen. Head viewed from below or straight from above, nearly three times broader than long, viewed obliquely from before and above, transversely rhomboidal; vertex flattened, two and a half times broader than an eye, clypeus a little longer than juga, eyes transverse and

strongly prominent but not large, their posterior margins seen from above straight, not quite touching the pronotal apical angles, ocelli much more distant from one another than from eyes, antenniferous tubercles not visible from above, almost perpendicular, antennæ inserted below the eyes, first joint very slightly passing apex of head, second and third joints slender, but a little incrassated at apex, fourth thickened, as long as the two preceding joints together, underside of head on each side with an oblique, more transversal than longitudinal tubercle somewhat inside the eyes, bucculæ very short, posteriorly not passing the insertion of the antennæ; rostrum a little passing base of venter, first joint reaching middle of prosternum. Pronotum neither transversely impressed nor laterally constricted, across the humeri less than three times wider than at apex, the space between the very narrow, smooth, and somewhat sunken cicatricial areas and the apical margin with a recurved finely impressed line beginning near the apical angle and ending at the corresponding point on the other side, and with a transverse row of punctures immediately behind the apical margin, the straight, apically a little rounded, lateral margins with a very narrow percurrent smooth keel visible only from the side, the broadly rounded basal margin seen from behind very narrowly depressed. Scutellum broader than long, a little convex. Elytra with the costal margins parallel from the base to beyond middle of corium, then a little rounded but not amplified; clavus with three rows of punctures, corium with two rows of punctures next to the claval suture and sparsely punctate in its exterior half, the apical margin shorter than the claval suture, straight, slightly sinuate in its interior part. Prosternum with a central, impressed, transverse line, which on the sides is curved forward, ending at the apical angles. Metapleura with the posterior border depressed, widened outward, the apical angle acute; orificia transverse, the opening small and round, callosely margined. Abdomen reaching a little beyond apical angle of corium. Fore femora unarmed, not incrassate. First joint of hind tarsi a little shorter than the others together.

Allied to *Pylorgus* Stål, but with much shorter bucculæ. The description of the latter genus is somewhat incomplete; but as Stål, in comparing his genus with *Ischnorhynchus*, does not mention that the head is much shorter and that the last joint of the antennæ and the first joint of the rostrum are much longer, we must infer that they are not constructed as in *Rhiophila*.

Type of the genus, *Rhiophila breviceps* sp. nov.

Rhiophila breviceps sp. nov.

Testaceous with a brownish tint, corium near the costal margin with three short fuscous streaks, one before, the two others side by side behind the middle, and with a few small fuscous spots in the disk, the apical angle brown, posterior angle of metapleura whitish, venter brown, rostrum brownish testaceous, antennæ and legs testaceous, base and a subapical annulation of second antennal joint and base of third black, fourth joint black with a subbasal testaceous annulation, a median ring to femora and apex of tarsi fuscous; above sparingly set with short erect pale hairs. Head above with a very short and fine pale sericeous pubescence, second antennal joint somewhat longer than first and slightly longer than third. Pronotum very thickly and finely punctate, scutellum and pleura less thickly so. Abdomen impunctate, beneath clothed with very tiny silvery scales, which on the sides are arranged in two longitudinal rows of small spots, fifth male ventral segment in the middle less than half the length of fourth, sixth a little shorter than the three preceding segments together.

Length, male, 2.6 millimeters, inclusive of membrane, 3.

LUZON, Laguna, Mount Banahao.

Viewed in profile this insect very much resembles a *Teracrius* in its general shape, but the abdomen is shorter.

Ninus insignis Stål.

Ninus insignis STÅL, Freg. Eug. Resa, Ins. (1859), 253, Pl. III, fig. 5.

LUZON, Laguna, Los Baños and Mount Maquiling.

This species was hitherto known only from Guam, but it is widely distributed; some of the specimens before me agree perfectly with the description of the Fijian *N. stylatus* Kirk., which is certainly a synonym, and *N. singalensis* Bredd. differs in no essential points and is apparently the same species. It is stated by Muir to be common on sugar cane in the Fiji Islands and will probably be found in many places in the Austro-Malayan Region if searched for on *Saccharum* and allied Gramineæ; yet Matsumura^a did not find it in Formosa among the 125 species of insects he states to be injurious to sugar cane in that island.

The genus *Ninus* Stål, with its single species, had hitherto been unknown to me and is apparently still unknown to Distant. The three species described by him as belonging to *Ninus*, as well as *N. sechellensis* Bergr. and *N. subsessilis* Kirk., appertain

^a Die schädlichen und nützlichen Insekten vom Zuckerrohr Formosas. Tokyo (1910).

to *Cymoninus* Bredd., a genus quite distinct from *Ninus*. Distant and I have both been misled by Stål's inaccurate figure of the head of *Ninus*. In this figure the eyes are represented as sessile, whereas they really are, as Stål correctly says in the description, "valde prosilientes, stylati." Yet the ocular peduncle is much less distinct if the insect be looked at straight from above, because the peduncle is directed somewhat upward; if the head be viewed obliquely from above, the peduncle is very conspicuous. These two genera, in both of which the head is somewhat expanded laterally, are readily distinguished by the following characters:

Ninus: Head at least as broad as base of pronotum; eyes small, pedunculate, placed very obliquely, strongly converging forward, ocular peduncle directed obliquely outward, forward, and upward; ocelli much more distant from eyes than from each other; rostrum extended to intermediate coxæ, first joint reaching middle of prosternum.

Cymoninus: Head narrower than base of pronotum; eyes rather large, sessile, placed longitudinally, scarcely converging forward; ocelli scarcely or slightly more distant from eyes than from each other; rostrum extended to middle of mesosternum, first joint reaching base of head.

The genus *Cymoninus* is much more allied to *Neoninus* Dist. than to *Ninus*.

Cymoninus philippinus sp. nov.

Testaceous-brown, above sparingly, erectly pilose; head beneath and along the margins above, a streak on vertex between ocelli, three posteriorly more or less abbreviated vittæ to pronotum, a median vitta to scutellum, and sometimes propleura, pale cinereous or, rather, covered with a bloom of that color that in some specimens is more or less rubbed off, elytra hyaline, corium with pale testaceous veins, its extreme apical angle brown, claval commissure whitish ochraceous, membrane with a brown apical vitta, abdomen above with a median fuscous vitta, beneath pale testaceous with a sublateral fuscous vitta; antennæ, rostrum (except the piceous apical joint), and legs testaceous. Head with the postocular part shorter than the eyes, first antennal joint also shorter than eyes, third joint distinctly shorter than second and fourth, which are almost equal in length, last three rostral joints of subequal length, each shorter than first. Pronotum, scutellum, and pleura finely and thickly punctulate, the lateral margins of the somewhat transverse pronotum a little roundedly prominent between middle

and apical angles. Corium with a row of fine punctures along the veins, the exterior half, moreover, with an extremely fine colorless puncturation, costal margin fimbriated with pale hairs near the base. Abdomen beneath with a fine and short recumbent pilosity, vagina of female reaching middle of venter.

Length, male, 2.7 millimeters, inclusive of membrane, 3; female, 3, inclusive of membrane, 3.5.

LUZON, Laguna, Los Baños.

Allied to *C. subunicolor* Bredd., but the form, sculpture, and color of the pronotum are different and the venter is marked on each side with a dark vitta.

Cymus tabidus Stål.

Cymus tabidus STÅL, Enum. Hem. (1874), 4, 126.

LUZON, Laguna, Los Baños and Mount Maquiling.

Cymus vulturinus Kirk. differs only by somewhat larger size and cannot, I think, be separated from it. The species is distributed from Queensland to tropical Africa, but had not before been recorded from the Philippines. The character given by Stål, "jugis apice distincte acute prominulis," is not distinct in all specimens.

Cymus sulcicollis sp. nov.

Oblong-elliptical, pale testaceous, head and apical margin of corium pale brownish, membrane hyaline, often with a brownish apical vitta, last antennal joint brown, rostrum beneath and at apex piceous; excluding abdomen finely and thickly punctulate, less finely and more seriatly so on corium and clavus. Head broader than long, a suppositional line drawn from outer margin of eye to apex of clypeus forming an acute angle with a corresponding line on the other side, first joint of antennæ very conspicuously passing apex of head, second joint not quite twice longer than first and slightly shorter than third, fourth somewhat shorter than second. Pronotum a little broader than long, on each side with a furrow within and parallel to the straight lateral margin, and in the middle of its apical half with a ridge terminated on each side by a furrow. Scutellum with a median ridge not quite reaching the base. Commissure of clavus more than one-half longer than scutellum. Vagina of female reaching distinctly beyond middle of venter.

Length, male, 3 millimeters, inclusive of membrane, 3.3; female, 3.5, inclusive of membrane, 3.8.

LUZON, Laguna, Los Baños and Mount Maquiling.

Somewhat related to *C. aurescens* Dist., but very distinct in

having the first antennal joint produced beyond the apex of the head, in the sculpture of the pronotum, and in the coloration.

MALCINÆ

Malcus flavidipes Stål.

Malcus flavidipes STÅL, Freg. Eug. Resa, Ins. (1859), 242, Pl. III, fig. 2; BANKS, Phil. Journ. Sci., Sec. A (1909), 4, 578; HORVÁTH, Ann. Mus. Nat. Hung. (1914), 12, 636.

LUZON, Benguet, Baguio.

This species was first reported from the Philippines by C. S. Banks, who collected it at Montalban, near Manila, and also recorded it from Palawan.

BLISSINÆ

Macropes philippinensis Distant.

Macropes philippinensis DISTANT, Rec. Ind. Mus. (1909), 3, 165, Pl. XI, fig. 7.

LUZON, Laguna, Los Baños and Mount Maquiling.

In both sexes of this species the greatest width of the pronotum is before the middle. The first two antennal joints and the tarsi are often darker than in Distant's type, and the second antennal joint is sometimes only as long as the third. The mesosternum has a percurrent median impression. The orificia are directed obliquely forward, slightly curved, passing middle of metapleura. The venter of the male is, as in the males of the other species, subcarinate in the middle. The front femora, in the male, are still more incrassate than in the female; but they are somewhat variable in shape, being broadly pyriform or sometimes subrectangular in outline, while in the female they are subtriangular. The hind femora are armed beneath with a few very small spinules. Distant's figure of the species is very good.

Macropes lacertosus sp. nov.

Black, including antennæ, rostrum, and legs; tarsi usually and venter, first antennal joint, and apex of femora sometimes paler. Elytra with the following white markings: A streak in apical half of clavus, a costal spot before middle of corium (not quite reaching its interior margin but outwardly extended into the epipleura), interior margin of corium (except near base), an oblong spot at exterior basal angle of membrane, a similar spot opposite at the interior margin, a smaller spot before middle of membrane, a very small spot at its interior basal angle (rarely, linearly, somewhat produced along the interior margin), and usually also apical border of membrane. Antennæ somewhat

shorter than head and pronotum together, first joint a little passing apex of head, second and third joints gradually somewhat incrassated from base to apex, subequal in length or third slightly shorter, fourth much longer than third. Rostrum reaching fore coxæ. Pronotum in the male with the greatest width before the middle and with the lateral margins more or less strongly rounded except near base, where they are straight and subparallel, in the female with the greatest width behind the middle, subparallel from base to middle, then rather strongly narrowed (but scarcely rounded) to apex, in both sexes impunctate, finely palely pubescent, the transverse impression alutaceous, the anterior lobe in the middle with two fine impressed longitudinal lines placed very near each other, the basal margin broadly but not deeply sinuate. Scutellum with a smooth median keel in the apical half. Elytra usually reaching base of last dorsal segment, sometimes a little shorter. Mesosternum convex, without a median impression. Orificia straight, directed a little obliquely forward, reaching middle of metapleura. Abdomen alutaceous, fourth ventral segment of female extremely short in the middle. Front femora in the male more incrassated and more spinous beneath than in the female; hind femora sometimes obsoletely spinous beneath.

Length, male and female, 5.6 to 7 millimeters.

LUZON, Laguna, Los Baños and Mount Maquiling.

Readily recognized by the structure and the sculpture of the pronotum and the distinct, well-defined white markings of the black elytra.

Pirkimerus parviceps sp. nov.

Narrow, linear, shining, piceous-black; basal border of pronotum often dark testaceous, elytra opaque, dark brown with blackish veins; commissure of clavus, an oblong subbasal costal spot to corium, an oblong spot at exterior basal angle of membrane, and a similar more or less distinct spot opposite at interior margin of membrane luteous; antennæ (except the fuscous apical joint), rostrum, and front legs testaceous, middle legs brownish testaceous, hind legs piceous. Head smooth, longer than broad, as broad as half the basal width of pronotum, eyes moderately prominent, seen from above much longer than broad, ocelli subcontiguous to eyes, antennæ as long as head and half the pronotum together, first joint linear, slightly passing apex of head, second and third somewhat incrassated from base to apex, subequal in length, each distinctly longer than first, fourth as long as first and second together and thicker than the others,

rostrum reaching fore coxæ. Pronotum one-half longer than broad, anterior lobe smooth but with an impressed percurrent median line, posterior lobe somewhat depressed, finely rugulose. Elytra reaching base of last dorsal segment. Abdomen very finely rugulose, shortly pilose. Hind femora not thicker than fore femora, beneath in the middle with two or three small spines; all tibiæ very shortly pilose; tarsi as long as femora, first joint incrassate, very shortly pubescent, in the fore and middle legs a little shorter than the tibia, in the hind legs as long as the tibia.

Length, male, 3.7 to 4.3 millimeters.

LUZON, Laguna, Los Baños and Mount Maquiling.

Rather similar in color to *P. sesquipedalis* Dist., but much smaller and differing by smaller and narrower head, narrower and more elongate eyes, ocelli subcontiguous to eyes, medially sulcated anterior pronotal lobe, finely rugulose (not coarsely punctate) posterior pronotal lobe, less thickened and less spinous hind femora, and less bristly hind tibiæ.

This genus was previously known only from Burma and the Andaman Islands.

Genus **RHABDOMORPHUS** novum

Body narrow, parallel-sided, about seven times longer than broad, distance from base of pronotum to apex of abdomen four times longer than head and pronotum together. Head about as long as broad, postocular part very short, but the eyes not quite touching anterior margin of thorax, antennæ with the first joint short but passing apex of head, fourth joint much the longest, rostrum rather short, first joint not reaching base of head, second equal to first, third slightly shorter, as long as fourth. Pronotum a little longer than broad, subparallel from base to middle, then narrowing toward apex, basal margin sinuate. Scutellum a little longer than broad, with a median carina not quite reaching base. Elytra not nearly reaching apex of abdomen, but with fully developed membrane, clavus and corium impunctate, but the radial vein bordered on each side by a row of punctures placed very close to the vein and therefore difficult to see; apical angle of corium very acute, its apical margin straight, as long as the claval suture, the two interior veins of the membrane united behind the middle, then continued as a single vein and joining the apex of the median vein forming a loop, the two exterior veins simple, but starting from the same point. Fore acetabula removed from base of prosternum, closed behind. Mesosternum with the xyphal area separated from the disk by

a transverse impression and with a median longitudinal impressed line reaching the transverse impression. Metasternum as long as mesosternum, orificia short, a little curved, directed outward. Venter at least twice longer than pectus. Middle legs a little separated. Front femora incrassate, spinulose beneath in the apical half; all tibiæ shorter than the femora; all tarsi as long as the tibiæ, first joint incrassate, subequal to the combined lengths of the other two.

Differs from the allied genera *Macropes* Motsch. and *Ischnodemus* Fieb. by the narrower body, the transversally placed orificia, the narrower scutellum, the venation of the membrane, the much longer abdomen, and the structure of the legs; from *Ischnodemus* also by the much shorter postocular part of the head.

Type of the genus, *Rhabdomorphus longurio* sp. nov.

Rhabdomorphus longurio sp. nov.

Black, basal border of pronotum pitchy testaceous, clavus and corium (including epipleura) pale lucid, membrane grayish white with black veins, abdomen (except last segment) brownish red, rostrum and legs testaceous; clothed with an extremely short and fine sericeous whitish pubescence, very sparingly so on the corium; basal border of pronotum and disk of mesosternum glabrous. Head finely rugulose, eyes rather small, moderately prominent, antennæ sublinear, a little shorter than head and pronotum together, second joint twice as long as first, third slightly shorter than second, fourth about as long as first and second united, rostrum reaching posterior margin of prosternum. Pronotum impunctate, the anterior half with a longitudinal median impression, the posterior half transversely rugulose, but with the basal border broadly levigate. Elytra extended somewhat beyond middle of antepenultimate dorsal segment, commissure of clavus shorter than scutellum. Abdomen very finely rugulose, disk of venter almost smooth, fifth ventral segment of female in the middle little more than one-third the length of fourth.

Length, female, 7 millimeters.

LUZON, Benguet, Baguio.

Genus *ANISOSOMA* novum

Body oblong-ovate. Head small, about as broad as long, distinctly broader than apex of pronotum, a little exserted, the lateral margins with a tubercle behind the eyes, clypeus passing apex of jugæ, ocelli more distant from each other than from

the moderately prominent eyes, antenniferous tubercles produced in an acute tooth, first joint of antennæ shortly oval, reaching apex of head, second a little longer than first, thickened from base to apex (the other joints wanting), bucculæ short and low, rostrum not quite reaching posterior margin of prosternum, first joint reaching anterior margin of eyes, second a little longer than first, third slightly shorter than first, fourth as long as second. Pronotum a little convex, without a distinct transverse impression, roundedly narrowing from base to apex, about three times broader at base than at apex, basal margin straight in front of scutellum, shortly sublobately produced over base of corium. Scutellum much broader than long, almost right-angled at apex, the disk with a T-shaped carination. Elytra much narrower than abdomen, corium and clavus impunctate excepting a row of punctures on each side of the veins, rimula straight, rather deeply impressed, forming an angle with the radial vein and ending a little behind middle of mesocorium, apical angle of corium narrowly rounded, apical margin obtuse-angularly sinuate in its interior portion, claval commissure as long as scutellum, membrane a little longer than corium, with five straight simple veins, the two inner ones joined a little before their common end. Front acetabula closed behind. Abdomen much broader than pronotum, oval with rounded sides, last dorsal segment about twice the length of the preceding segment, connexivum broad, its greatest part not covered by the elytra. Fore coxæ not nearly reaching posterior margin of prosternum; femora elongately subclavate, the fore and middle pair beneath near apex armed with a few very minute teeth; fore tibiæ slightly shorter than femora; first joint of hind tarsi as long as third, second extremely small.

Distinguished from all other genera of this subfamily by the broad oval abdomen; to be placed between *Ischnodemus* Fieb. and *Blissus* Klug, differing from the former by the sinuate apical margin of the corium, from the latter by the posteriorly closed fore acetabula.

Type of the genus, *Anisosoma lativentris* sp. nov.

Anisosoma lativentris sp. nov.

Black, disk of venter fuscous, elytra dingy grayish white, the punctures and veins of membrane a little darker, base of clavus a little infuscated, abdomen above and lateral borders of venter dingy ochraceous, rostrum (except the fuscous apical joint) and tarsi testaceous. Head half the length of pronotum, extremely finely punctate. Pronotum slightly broader than long, thickly

and finely punctate, lateral margins slightly sinuate in the middle. Elytra reaching somewhat beyond base of last tergal segment, corium a little beyond base of third connexival segment. Pectus finely punctate, more distinctly so on posterior part of propleura. Abdomen beneath very finely rugulose with an extremely short, deciduous, scaly, golden pubescence, fifth ventral segment of female four times longer at the sides than in the contracted middle, female genital segment somewhat shorter than sixth ventral segment.

Length, female, 4.5 millimeters.

LUZON, Laguna, Mount Maquiling.

PACHYGRONTHINÆ

Teracrius bipunctatus sp. nov.

Testaceous, thickly punctate with brown, corium and clavus much paler with concolorous puncturation, base of pronotum somewhat blackened in front of scutellum, interior basal angle of clavus and apical margin of corium in its interior half with a piceous dot, membrane hyaline; antennæ, rostrum, and legs testaceous, apex of second antennal joint, a superior vitta to front femora, and a subbasal and subapical annulation to all tibiæ fuscous; body beneath with a whitish sericeous pubescence. Head less than half the width of pronotum, eyes rather small but prominent, antenniferous tubercles with their exterior margins parallel, underside of head not tumescent, but with a slightly curved median transverse impression, last three antennal joints subequal in length or third slightly the shortest, rostrum reaching middle of mesosternum, first joint distinctly passing anterior margin of prosternum. Pronotum with a very narrow, slightly elevated median keel extended from the base to somewhat beyond the middle, the lateral margins almost straight. Scutellum broader than long, with a smooth median ridge not quite reaching the base. Elytra reaching apex of abdomen, apical margin of corium moderately sinuate in its interior part. Front femora strongly incrassated, two and one-half times longer than broad, front tibiæ a little curved.

Length, female, 3.5 millimeters.

LUZON, Laguna, Los Baños.

Allied to *T. burmanus* Dist., but smaller, differently colored, and with the rostrum and second antennal joint longer.

Pachygrontha cruenta sp. nov.

Tawny (including antennæ and legs), a narrow vitta within anterior part of pronotal lateral margins, a humeral spot, a

short apical streak to clavus, two anteriorly and posteriorly abbreviated vittæ to the hyaline membrane, a sublateral vitta to venter, and tarsi (except basal joint from base to near apex) fuscous; apical part of corium (beginning at the level of inner apical angle) sanguineous; a basal spot to scutellum, a spot at apical margin of corium a little before its middle, head beneath in the middle, median part of sterna, and vagina of female black; median basal part of venter pale ochraceous, rostrum pitchy testaceous, femora (especially the first pair) rather densely dotted with piceous; brown-punctured, but puncturation of corium almost concolorous and venter impunctate. Head broader than apex of pronotum, antennæ as long as body, first joint not quite so long as head, pronotum, and scutellum together, second at least one-fourth shorter than first, third about one-fourth shorter than second, fourth about half the length of third. Pronotum a little broader than long, without a distinct transverse impression, but with a fine longitudinal median keel reaching neither base nor apex, lateral margins straight. Scutellum with a semicircular, impunctate basal elevation, continued in a straight line to the apex. Corium with simple, nowhere callose, apical margin. Front femora with about four larger and several smaller spines.

Length, female, 6.7 millimeters.

MINDANAO, Davao.

Allied to *P. lewisi* Dist., but smaller, with shorter third antennal joint and quite differently colored pronotum and corium. According to the figure of Distant's species the apical angles of the last three abdominal segments are produced in a slender spine. No such spines are present in *cruenta* or any other *Pachygrontha* known to me, and they are not mentioned in Distant's description.

Pachygrontha bicornuta Banks⁷ is identical with *P. miriformis* Bredd.⁸

OXYCARENINÆ

Oxycareus lugubris Motsch.

Oxycareus lugubris MOTSCHULSKY, Etud. Ent. (1859), 8, 108.

LUZON, Laguna, Los Baños.

This species has hitherto been recorded only from Ceylon, but *O. limbatipennis* Bredd., from Lombok, is evidently the same species. In Ceylon it has been stated by Green to infest the ripe bolls of the cotton, discoloring and caking the cotton. Several

⁷ *This Journal*, Sec. A (1909), 4, 574, Pl. I, fig. 5.

⁸ *Mitt. Nat. Mus. Hamburg* (1905), 22, 213.

other species of this genus are injurious to cotton, especially *O. hyalinipennis* Costa (*laetus* Kirby), which is widely spread in tropical Africa and Asia. Some of them seem to be spreading, more and more, probably being transported by trading vessels. I have received the Indian *O. bicolor* Fieb., of which *O. heraldus* Dist. is a variety, from different places in Australia.

The white costal margin behind the large subbasal spot of the corium in *O. lugubris* is sometimes very indistinct; and the rostrum is variable in length, sometimes not reaching the base of the venter, but occasionally extending almost to its middle.

Horváth has rightly united the genus *Maruthas* Dist. with *Oxycarenum* Fieb. As in so many similar cases Distant maintains the separateness of his genus, referring to the "structural differences" pointed out in his description. These differences are said to be "the length of the rostrum, the spinous anterior femora and the membrane not reaching addominal apex." As *Oxycarenum* is a well-known genus described by several authors, including Distant himself, it is curious that he is unaware that the anterior femora are spinous in all species of *Oxycarenum*; that the rostrum, as pointed out by Stål, sometimes even reaches the apex of the abdomen; and that the membrane does not quite reach the abdominal apex, and cannot be relied on even as a specific character.

Oxycarenum bicoloratus new name.

For the New Caledonian *O. (M.) bicolor* Dist., the name of which is preoccupied, I propose the name *Oxycarenum bicoloratus*.

(To be concluded.)

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STUDIES IN PHILIPPINE HETEROPTERA, I

By E. BERGROTH

(Jümsä, Finland)

(Concluded.)

MYODOCHINÆ

Porta gracilis Distant.

Porta gracilis DISTANT, Fasc. Malay. (1903), 1, 246, Pl. XV, fig. 6.

LUZON, Laguna, Mount Banahao.

This insect was previously known only from the Malay Peninsula. In my redescription of the genus *Porta** I compared it with the genus *Vertomannus* Dist. "as redescribed by Breddin," but I have since found that *Vertomannus* Bredd. is distinct from *Vertomannus* Dist. and forms another genus, which I have recently described under the name *Omacrus*.

Genus *TACHYTATUS* novum

Body elongate. Head exserted, as long as broad and as broad as anterior pronotal lobe, somewhat shorter than pronotum, seen from above rhombic, postocular part a little shorter than anteocular part and subequal in length to eye, subsinuately rather strongly narrowed from eyes to base, eyes rather large but moderately prominent, ocelli placed as far from each other as from eyes, vertex one-half broader than an eye, antenniferous tubercles immediately before the eyes; antennæ very slender, as long as or a little longer than body, first joint somewhat shorter than head and passing its apex by two-thirds the length of the joint, second more than twice the length of first, third a little shorter than second, fourth subequal to second; bucculæ very short, rostrum reaching middle of mesosternum, first joint not nearly

* Ann. Soc. Ent. Belg. (1914), 27, 28.

reaching base of head, subequal to or slightly shorter than first antennal joint, second subequal to first, third shorter than second but longer than fourth. Pronotum strongly narrowed from base to apex, at the base one-half broader than head, transversely bluntly impressed a little before the middle, where it is somewhat constricted, lateral margins vertically obtusely rounded, basal margin almost straight, posterior lobe rather strongly declivous, anterior lobe a little less so, one-third narrower than posterior lobe, moderately convex with little-rounded lateral margins, collar narrow. Scutellum longer than broad, a little convex. Metasternum with acute posterior angles. Elytra a little longer than abdomen, clavus with three, often somewhat irregular or confused and partly abbreviated, rows of punctures, its commissure more than half the length of the scutellum, apical margin of corium straight, somewhat shorter than the claval suture, membrane with four, in the basal half somewhat curved veins. Legs long and slender, front femora a little incrassate in the basal half, gradually narrowing toward apex, beneath with a row of rigid setæ arising from very minute granules, tibiæ straight, the middle and hind pair set with slender bristlelike spines, first joint of hind tarsi somewhat variable, at least two, but sometimes nearly three, times longer than the other joints united.

This genus is allied to the Indo-Malayan genera *Vertomannus* Dist., *Omacrus* Bergr., and *Porta* Dist. and forms with them a distinct group in the division Myodocharia, characterized by the elongate, slightly incrassated front femora. Apart from other important characters, *Tachytatus* differs from *Vertomannus* in the very much shorter postocular part of the head, from the two other genera in the unarmed humeral angles of the pronotum.

Type of the genus, *Tachytatus prolixicornis* sp. nov.

Tachytatus prolixicornis sp. nov.

Black with a leaden bloom, basal half of posterior pronotal lobe, an oval, submedian, scutellar spot, an oval, subapical, claval spot, and posterior half of corium velvet-black without a paler bloom, corium with a transverse luteous dot near inner apical angle, and somewhat before outer apical angle with a quadrangular or posterointeriorly rounded white costal spot almost reaching the apical margin, membrane fuscous, a large triangular interior basal area black, extreme outer basal angle and apex whitish; extreme basal margin of pronotum usually obscurely testaceous, extreme apex of scutellum and posterior

metasternal angles, basal half of corial epipleura, lateral margins of fourth ventral segment and a diffuse median spot to female venter pale testaceous; antennæ testaceous, first and third joints at apex and second joint just before apex fuscous, fourth joint fuscous-black, apex of second joint and a subbasal annulation of variable breadth to fourth joint white; rostrum piceous, second joint pale testaceous; legs testaceous, coxæ black, front femora more or less infusate, basal half of middle femora and less than basal half of hind femora whitish testaceous, apical half of middle femora and more than apical half of hind femora fuscous or blackish, first joint of tarsi very pale testaceous, their last two joints and sometimes apex of first joint and of tibiæ infusate; pronotum and scutellum rather thickly punctate, corium with the usual rows of fine punctures along the veins and apical margin, otherwise impunctate, except the posteriorly widened exocorium, which is irregularly somewhat thickly punctate in front of the white anteapical costal spot; head, pronotum, and scutellum erectly pilose, the hairs easily coming off.

Length, male, 6.2 to 6.8 millimeters; female, 7 to 8.

Variety.—Antennæ and tibiæ (at least the hind pair) black, basal half of first antennal joint sometimes testaceous, the white markings of the second and fourth joints as in the type, base of tibiæ usually pale testaceous.

LUZON, Laguna, Los Baños, Mount Maquiling, and Mount Banahao; Tayabas, Malinao. MINDANAO, Davao.

Apparently a common insect in the Philippines.

Bedunia praecipua sp. nov.

Black; apical margin of pronotum, lateral and basal borders of posterior pronotal lobe, the curved transverse callosity of the scutellum, clavus, corium, and a transverse apical spot to membrane pale ochraceous; a posteriorly widened, percurrent, claval vitta, the claval suture and a narrow almost percurrent vitta to corium, near the suture; two anteriorly united streaks in basal half of corium, a suboval patch at its inner apical angle, a costal vitta opposite it, and a suboval spot near the outer apical angle black; first antennal joint brown, second testaceous with brownish apex, third (except the testaceous base) and fourth (except a subbasal white ring) black; rostrum and legs pale testaceous, coxæ, fore femora, apical fourth of middle femora, apical third of hind femora, and apex of all tibiæ fuscous. Head as long as pronotum, clypeus slightly prominent before base of rostrum, blunt at apex, first joint of antennæ a little shorter than head, rostrum reaching somewhat beyond base of third ventral seg-

ment. Pronotum with the anterior lobe finely and thickly punctate, excepting some irregular smooth markings, posterior lobe rather coarsely and sparsely punctate, excepting the impunctate ochraceous borders. Scutellum thickly and rather coarsely punctate, with a median, sparsely punctate, curved, transverse callosity, emitting a keel to the apex. Elytra reaching apex of abdomen, clavus coarsely punctate; corium, apart from the usual seriate black punctation, finely and thinly punctured with black in the apical part of the mesocorium. Abdomen with the apical angles of the sixth female segment produced in a short triangular tooth. Front femora rather strongly incrassate, about three times longer than broad, front tibiæ (female) slightly curved, first joint of hind tarsi nearly thrice longer than the other joints together.

Length, female, 10 millimeters.

LUZON, Laguna, Mount Banahao.

Of this splendid and well-marked species I have seen but a single specimen.

Genus *PAMERANA* Distant

Pamerana DISTANT, Ann. & Mag. Nat. Hist. (1909), VIII, 3, 331; Fauna Brit. Ind., Rhynch. (1910), 5, 53.

Body elongate. Head exserted, horizontally porrect, longer than broad, conically produced in front of the antenniferous tubercles, which seen from above are usually directed more or less obliquely outward, their exterior margins usually being more or less divergent; eyes large but moderately prominent, postocular part shorter than the space between eyes and base of antennæ, very slightly narrowed from eyes to base, with slightly rounded sides, vertex less than twice broader than an eye, with two longitudinal, slightly curved, subimpressed, levigate lines in front of the ocelli, which are rather large and a little more distant from each other than from eyes; first joint of antennæ shorter than head but considerably passing its apex, second joint at least twice the length of first, third slightly shorter than second, fourth about as long as second, the low bucculæ evanescent in the middle of the horizontal throat, first joint of rostrum not reaching base of head, usually equal in length to first antennal joint, second a little longer than first. Pronotum longer than head and at the base twice broader, strongly constricted and transversely impressed near or behind middle, lateral margins vertically convex, not carinate, basal margin straight, posterior lobe somewhat sloping, strongly narrowed from base to its apex, broader than the laterally somewhat rounded an-

terior lobe, which is less declivous than the posterior lobe and has its greatest width behind the middle, collar well marked, at the sides usually shortly, dentately produced outward. Scutellum subequilaterally triangular with a feebly marked, Y-shaped, percurrent, impunctate ridge, the anterior branches of which are scarcely elevated. Elytra with their costal margins parallel from base to beyond middle, exocorium gradually widening from end of its basal fifth to beyond middle, then subparallel, clavus with four rows of punctures, the second (next inner) row abbreviated anteriorly (where it joins the third row) and posteriorly, the commissure more than half the length of scutellum, corium with the rimula running along inner margin of radius, ending behind its middle, disk of mesocorium with a row of punctures along the posterior part of the rimula and continued to the apical margin, which is straight, shorter than the claval suture; membrane with an oblique transverse impressed fold near the base. Metapleura with acute posterior angles. Abdomen beneath more or less distinctly keeled on the middle. Fore femora incrassate, with the basal half thicker than the apical half, more or less spined beneath, fore tibiæ straight, middle and hind tibiæ sparsely set with short bristles, first joint of hind tarsi less than two times longer than the others together.

Distant placed the genus near *Pamera*, to which it has a superficial resemblance, but in my opinion it is more related to *Altomarus* Dist. and *Bedunia* Stål, although the postocular part of the head is much shorter. As the original description of the genus is defective and as Distant knew but one species of it, I have thought it necessary to redescribe it. The scheme of coloration is the same in each of the four species hitherto known.

Pamerana subinermis sp. nov.

Black, venter somewhat paler in hue, sometimes dingy testaceous; pronotum (except in the middle and laterally) and apical margin of prosternum, two vittæ and a small humeral spot to posterior pronotal lobe, posterior half (or somewhat more) of scutellar lateral margins, a short basal streak and the interstice between the two exterior rows of punctures of clavus (except toward apex), the claval suture and commissure, an oblong spot near inner apical angle of corium, its cubital vein from base to beyond middle, a short subapical streak on the radial vein (and sometimes the adjacent part of the meso- and exocorium and an oblong central suffusion to the latter), costal border of corium (except the extreme margin), and the

extreme exterior basal angle of the membrane and its veins luteous; antennæ dark fuscous, the fourth joint with a pale testaceous annulation reaching from near base to the middle, rostrum and legs tawny, femora a little darker toward apex, tarsi fuscous at apex. Head alutaceous, with a few erect hairs, slightly longer than broad, about one-fourth narrower than anterior pronotal lobe, a little widened from anterior angle of eyes to apex of antenniferous tubercles; antennæ a little shorter than the body, first joint passing apex of head by more than half its length; rostrum scarcely passing middle coxæ. Pronotum somewhat broader than long, anterior lobe scarcely longer than posterior lobe, impunctate, with very few erect hairs, laterally, finely, transversely rugulose, collar with a (sometimes indistinct) transverse impressed line, posterior lobe sparsely punctate. Scutellum (except the Y-shaped elevation) somewhat thickly punctate. Exocorium and outer apical part of mesocorium sparsely and rather coarsely punctate. Pectus alutaceous. Abdomen beneath with a short and moderately dense sericeous pubescence and a long and very fine exserted hair near the posterior angles of the last three segments. Front femora beneath with very few minute tubercles and near apex with one or two very small spinules; front tibiæ unarmed in both sexes.

Length, male, 6 millimeters; female, 6.7.

MINDANAO, Davao.

Closely allied and very similar to *P. cuneata* Dist., but narrower, with much less divergent antenniferous tubercles and much less spinous fore femora.

Pamerana procera sp. nov.

Dark castaneous; head, scutellum, meso- and metasternum black; membrane fuscous; apical margin of pronotum and of prosternum, two vittæ, a large sublateral suffusion, lateral margins and a small humeral spot to posterior pronotal lobe, two small spots to scutellum and posterior half of its lateral margins, corium and clavus (except the fuscous punctation), exterior basal angle and veins of membrane, posterior margin of propleura and metapleura, and connexivum and lateral margins of venter luteus; antennæ, rostrum, and legs testaceous, apex of the first three antennal joints and fourth joint fuscous-black, the latter not far from the base with a whitish annulation reaching the middle, coxæ pitchy black, femora (excluding basal half of the hind pair) with small brown spots arranged in longitudinal rows and somewhat dusky toward apex, tarsi fus-

cous at apex. Head alutaceous, and very finely pubescent with a few erect hairs, one-third longer than broad, about one-third narrower than anterior pronotal lobe, a little widened from anterior angle of eyes to apex of antenniferous tubercles, antennæ a little shorter than the body, first joint passing apex of head by more than half its length, rostrum reaching middle coxæ. Pronotum slightly longer than broad, anterior lobe twice the length of posterior lobe, impunctate (except a transverse row of punctures on the collar), posterior lobe sparsely punctate. Scutellum rather coarsely punctate, more finely so between the anterior branches of the Y-shaped impunctate elevation. Corium rather coarsely and thickly punctate in the exocorium and exterior apical part of mesocorium, a fasciate marking between costal and apical margins somewhat before apical angle sparingly punctate, and oblong spot near inner apical angle impunctate. Pectus finely but distinctly punctate. Abdomen beneath with a dense but extremely short dustlike pubescence and a long and very fine exserted hair near the posterior angles of the last three segments. Fore femora beneath with a row of spines and with one spine out of the line of the others; fore tibiæ of male beneath with a row of short acute teeth.

Length, male, 8 millimeters.

MINDANAO, Davao.

Much larger, more elongate, and paler than the preceding species, with longer head, much longer anterior pronotal lobe, more spinous front femora, and toothed front tibiæ in the male.

Pamerana subgenerica sp. nov.

Black, pronotum and scutellum dark castaneous, posterior pronotal lobe and elytra dark testaceous, with fuscous punctation, corium with a brown costal spot behind the middle, venter castaneous; antennæ, rostrum, and legs testaceous, last antennal joint (except a whitish testaceous subbasal annulation reaching the middle), a ring a little before apex of hind femora, and apex of tarsi fuscous; coxæ black or piceous; head, pronotum, and scutellum sparsely erectly pilose, venter with a moderately dense, and not very short, pallid sericeous pubescence. Head somewhat longer than broad, but little narrower than anterior pronotal lobe, not widened from anterior angle of eyes to apex of antenniferous tubercles, the exterior margins of the latter being subparallel, antennæ conspicuously shorter than the body, first joint passing apex of head by less than half its length, rostrum reaching hind coxæ, first joint two-thirds longer than first antennal joint. Pronotum almost as long as broad,

anterior lobe one-half longer than posterior lobe, impunctate, with a transverse row of fine punctures, laterally blunt, not dentately produced outward, posterior lobe irregularly, sparsely punctate, with two paler vittæ less punctate. Scutellum (except the Y-shaped elevation) finely punctulate. Corium irregularly, rather sparsely and finely punctate in the exocorium and exterior apical part of mesocorium, an oblong spot near inner apical angle impunctate. Pectus finely and rather thickly punctate. Fore femora almost fusiformly incrassate, their greatest width being but little farther from apex than from base, armed beneath with two rows of spines, the inner row reaching from apex to a little beyond middle, the outer row extended only through the apical fourth; fore tibiæ unarmed.

Length, male, 5.3 millimeters.

MINDANAO, Surigao.

This species differs from the others by the exteriorly parallel, not divergent antenniferous tubercles, the shorter first antennal joint, and the laterally blunt, not dentately prominent, pronotum. It might be regarded as subgenerically distinct, but it is in all essential characters a *Pamerana*, and there can be little doubt that forms intermediate between this species and the others will be detected in the future.

Narbo metochoides sp. nov.

Dull black; membrane and venter dark fuscous; two median spots and apex of scutellum, a small round median spot to corium, basal half of its costal margin, a large costal spot almost reaching apical margin somewhat before the apical angle, a small spot at outer basal angle of membrane, its apex, a few speckles on the basal part of its veins, and an oblong lateral basal spot to fourth and fifth abdominal segments pale ochraceous; the lateral keel of prothorax, veins of corium in the basal half, and the median part of its apical margin more or less obscurely ferruginous; antennæ, rostrum, and legs testaceous; first antennal joint fuscous, apex of second (narrowly) and of third (more broadly), and fourth joint fuscous-black, the latter with a broad subbasal whitish annulation, last rostral joint and coxæ black, front femora (except base) and more than apical half of middle and hind femora castaneous or fuscous, apex of tibiæ and of first tarsal joint, and the whole third joint fuscous. Head impunctate, as broad as anterior pronotal lobe, antennæ a little longer than body, second joint one-half longer than first, third slightly shorter than second, fourth as long as second, rostrum barely reaching middle coxæ. Pronotum slightly broader than

long, the lateral margins also in the posterior lobe distinctly and acutely carinate, anterior lobe longitudinally scarcely convex, sparingly and very finely punctulate, more thickly and distinctly so near apical and lateral margins, the latter slightly rounded, posterior lobe subequal in length to anterior lobe but more sloping and a little more than one-half broader than it, rather coarsely and sparsely punctate with a longitudinal median keel, shortly and faintly subsinuate behind the obsoletely subdentately prominent humeral angles. Scutellum sparingly and finely punctate, but rather coarsely and thickly so near the lateral margins and with an impunctate median ridge in the apical half. Corium (apart from the usual seriate punctation along the veins) impunctate, only the exocorium sparsely punctate, the few points of the large costal spot fuscous. Pectus finely and sparsely punctate. Abdomen beneath with a thick but very short pale sericeous pubescence. Fore femora with a row of about four spines and a second row of a few, minute, acute granules; first joint of hind tarsi two and one-half times longer than the others together.

Length, male, 10 millimeters; female, 11.

Variety.—Lateral borders of abdomen pale ochraceous except at apical angles of the last three segments.

LUZON, Laguna, Mount Maquiling.

Apparently allied to the imperfectly described *N. biplagiatus* Walk., but with different coloring of the antennæ, pronotum, scutellum, etc.; in its general aspect and coloration much resembling the species of *Metochus*, a genus that in fact is more related to *Narbo* than to *Dieuches*.

Pocantius vittatus sp. nov.

Black; lateral margins of prothorax, posterior pronotal lobe, apical half of scutellum (excluding a narrow median vitta), corium and clavus, posterior part of propleura and metapleura, posterior margin of mesopleura, all acetabula, and lateral border of second and third ventral segments and of anterior half of the three following segments ochraceous; finely and thickly punctured with black or brown (excluding the impunctate lateral margins of prothorax and venter, a smooth narrow median vitta to posterior pronotal lobe, and the acetabula), a diffuse spot in basal half of corium, and a vitta extended from middle of corium to its apical margin black; a short, slightly oblique, longitudinal brown streak near costal margin of corium behind the middle, membrane fuscous; antennæ and rostrum black, first antennal joint stramineous at base and apex, second

rostral joint narrowly testaceous at base; legs fuscous-black, middle and hind trochanters, base of middle and hind femora, extreme apex of front femora, and front and middle tibiæ (except apex) testaceous. Head above with a few exserted hairs, first joint of antennæ in its apical half with some short rigid setæ, second not quite thrice the length of first, third subequal in length to second, gradually somewhat thickened from base to apex (fourth wanting), rostrum reaching middle coxæ. Pronotum slightly broader at base than long in the middle, lateral margins straight, basal margin broadly and slightly sinuate, anterior lobe conspicuously longer than posterior lobe, alutaceous, impunctate, with a round foveate impression on each side near the base, and another small fovea (visible only from the side) near lateral margins. Scutellum very finely and superficially punctulate in the basal half. Elytra reaching apex of abdomen. Pleura (except the punctate posterior borders) extremely finely rugulose. Abdomen underneath with a very short, sericeous grayish pubescence. Front femora with two very short spinelets in the apical half. First joint of hind tarsi three times longer than the other joints united.

Length, female, 5 millimeters.

LUZON, Laguna, Los Baños.

Allied and very similar to *P. pedatus* Dist., but with longer anterior pronotal lobe and hind metatarsus and differently colored antennæ and legs.

On the species *pedatus*, Distant founded the genus *Naudar-ensia*, which differs from *Poeantius* only in having straight pronotal lateral margins, while they are slightly sinuated in *Poeantius*. This differential character and those mentioned by Distant are only specific; I agree with Breddin that these genera must be united.

Cligenes assimulans sp. nov.

Black or dark brown; a broad apical fascia to posterior pronotal lobe and the elytra whitish with fuscous puncturation, corium with a median costal spot, a larger (sometimes triangular) spot at interior apical angle and a spot occupying the exterior apical angle black; antennæ brown or brownish testaceous, last joint (and sometimes apex of third) white, rostrum testaceous, the first two joints often brown, front legs brown, middle and hind legs whitish testaceous with apex of femora infusate, but all legs sometimes testaceous with the tibiæ infusate. Head broader than long, second joint of antennæ twice the length of first, third a little shorter than second

and subequal to fourth. Pronotum with the basal margin broadly and not very deeply sinuate, lateral margin a little sinuate, the front lobe almost impunctate, somewhat longer than the finely and sparsely punctate rear lobe. Scutellum very finely and sparsely punctate. Corium and clavus finely punctate. First joint of hind tarsi three-fourths longer than the other joints together.

Length, female, 2.5 to 3.3 millimeters.

LUZON, Laguna, Mount Maquiling. MINDANAO, Butuan.

In the unusual coloration of the pronotum this species much resembles the Indian *C. signandus* Dist., but according to the description and figure the apical margin of the corium in *signandus* is straight, which would place it in *Antillocoris*. Distant has, however, in so many cases described this margin as straight in species that have it conspicuously sinuate in the interior half, that the possibility and even probability of *signandus* being a true *Cligenes* must be taken into account. In some of the small Myodochidæ with interiorly sinuate apical margin of the corium the membrane has near the sinuosity a fold that, if not carefully examined, may be mistaken for a straight continuation of the exterior half of the corial apical margin, especially if this margin be of almost the same color as the membrane. This is the case with the two new species of *Cligenes* described in the present paper. At any rate *C. assimulans* cannot be the same species as *signandus*, the antennæ being quite differently colored, and the pronotum less deeply sinuate basally in *assimulans*.

Cligenes validulus sp. nov.

Oval, somewhat plump, black, apex of scutellum and a spot on acetabula testaceous, corium and clavus of a livid whitish testaceous hue with blackish puncturation, apical angle of corium somewhat blackened, membrane hyaline, male genital segment castaneous; antennæ, rostrum, and legs testaceous. Head almost impunctate, first joint of antennæ shorter than second and almost as long as third, fourth slightly longer than third. Pronotum finely and rather thickly punctate, lateral margins very slightly sinuate behind middle, basal margin broadly sinuate. Scutellum punctate, the same as pronotum. Corium finely punctate. First joint of hind tarsi somewhat longer than the others together.

Length, male, 2.3 millimeters.

LUZON, Laguna, Mount Banahao.

This is one of the species that, if seen straight from above,

appear to have the apical margin of the corium straight; that this margin really is rather deeply sinuate interiorly is obvious, if the insect be looked at obliquely from the side or from behind.

Antillocoris helvipennis sp. nov.

Oblong-oval, black, scutellum (excluding the transverse posteriorly rounded basal area) and elytra testaceous with a more or less distinct golden luster, especially on the membrane; corium and clavus punctured with fuscous; antennæ, rostrum, and legs testaceous, base of third and fourth antennal joints fuscous; coxæ and femora piceous. Head shining, impunctate above, finely punctulate beneath, second joint of antennæ one-half longer than first, third subequal to first and a little shorter than fourth, rostrum a little variable in length, reaching base of venter or of third ventral segment. Pronotum finely and rather sparsely punctate, with a transverse, percurrent, antemedian, impunctate area, lateral margins slightly sinuate, basal margin straight. Scutellum moderately thickly and somewhat coarsely punctate, the black basal area more finely punctate and emitting an impunctate median keel to the apex. Corium, apart from the usual seriate punctation along the veins, punctulate only in the outer apical area of the mesocorium. Underside of body mostly impunctate, but pectus with a row of coarse punctures in the transverse impression of the propleura and metapleura. First joint of hind tarsi not quite twice the length of the others together.

Length, male, 2.8 millimeters; female, 3.3.

LUZON, Laguna, Mount Maquilang.

Mizaldus montiscandens sp. nov.

Black, elytra translucent, whitish, apical angle of corium black; antennæ fuscous, apical half of first and extreme apex of second joint whitish (fourth joint wanting); rostrum testaceous, basal joint fuscous; legs stramineous, coxæ, trochanters, and extreme base of femora piceous, apical third of hind femora slightly tinted with brownish. Head, pronotum, and scutellum very thickly and finely punctured, antennæ about half the length of the body, posterior pronotal lobe distinctly shorter than anterior lobe, its basal margin in front of elytra depressed and very slightly lobately produced. Elytra reaching apex of abdomen, the claval rows of punctures and the two adjacent corial rows very palely brownish, the rest of corium impunctate, only the exterior half with an oblong median area very finely punctured with blackish.

Length, female, 3.2 millimeters.

NEGROS, Cuernos Mountains.

Smaller than *M. lewisi* Dist. and with shorter antennæ, the pronotal basal margin less lobately produced before base of elytra, only the apical angle of corium black (not the large adjacent area), and with differently colored antennæ and legs.

This genus was previously known from India and New Guinea.

To the generic characters of *Mizaldus* Dist. should be added: Head broader than long, eyes rather large, distance between them and base of antennæ much shorter than an eye, first joint of rostrum as long as basal joint of antennæ, basal margin of pronotum in front of elytra depressed and more or less lobately produced,¹⁰ scutellum broader than long, at apex very shortly carinate and acuminate, clavus with three rows of punctures, the commissure one-third the length of scutellum, apical margin of corium sinuate in its interior half, veins of membrane almost straight, fourth ventral segment with two sublateral glandular spots, the posterior of which is placed midway between the basal and apical margins, front femora little incrassated, unarmed, first joint of hind tarsi one-half longer than the other joints together.

Distant says in his description of the genus: "head long, pronotum with the anterior angles a little prominent, a little more than half the width of base, the lateral margins very strongly sinuate." All these characters are wrong and at variance with his figure, which is correct, barring the apical margin of the corium, which is represented as straight. The corium in its inner half is rather feebly separated from the membrane, but it is not difficult to trace the whole apical margin, which in its interior half is rather deeply and angularly sinuate.

Faelicianus summus sp. nov.

Oblong, glabrous, black (rarely castaneous), pronotum with the depressed lateral margins luteous (above and beneath) from their apex to a little beyond the transverse impression, posterior pronotal lobe with a more or less distinct testaceous spot or vitta on each side, rarely with a median longitudinal whitish line in its anterior half, clavus with a rather long basal and a short apical streak luteous, corium in its basal part (as far as to the level of the scutellar apex and including the corresponding part of the epipleura) luteous, followed by a broad fuscous fascia,

"This character is thus described by Distant: "lateral angles excavated."

sometimes paler or subinterrupted in the middle, and always including a round luteous or whitish spot near the inner apical angle, the apical part luteous or brownish or fuscous, but the greatest part of it usually occupied by a large whitish spot divided by the dark radial vein, and always immediately behind the fuscous fascia with a subquadrate whitish costal spot often subconfluent with the larger whitish spot, apical margin and apical angle fulvous or dark ochraceous, membrane black with ochraceous basal margin, whitish gray apical margin, and three whitish spots (a rounded one not far from the inner basal angle and an oblong one at the outer basal angle and at the interior margin); abdomen sometimes piceous or castaneous or even tawny; antennæ and rostrum testaceous, second antennal joint rarely reddish at apex, third more or less infuscated at least in the apical half, usually with the apex reddish, fourth joint fuscous, usually with a subapical (and rarely a subbasal) reddish annulation, coxæ and trochanters piceous black, front femora pitchy castaneous with the apex paler, rarely entirely testaceous, middle and hind femora whitish, more or less broadly brownish at apex, all tibiæ and tarsi pale testaceous; thickly and very finely punctulate, a little less finely so on posterior pronotal lobe, more sparsely punctate on corium, abdomen impunctate. Head a little broader than long and half the width of pronotum, very slightly exserted, eyes rather large, not quite touching apical margin of pronotum, ocelli more distant from median line of head than from eyes, vertex three times broader than an eye, without exserted setæ, exterior margins of antenniferous tubercles parallel, distance between eyes and base of antennæ much shorter than an eye, underside of head with a rostral groove slightly passing the middle of the throat, but without distinctly elevated bucculæ, antennæ a little shorter than the body, first joint passing apex of head by three-fourths its length, second joint the longest of all, about half as long again as first and like it gradually somewhat thickened from base to apex, third one-third longer than first and thicker than second, a little narrowing toward the base, fourth a little shorter and thicker than third, rostrum extended to middle coxæ, first joint reaching base of head, second subequal to first, reaching fore coxæ, scarcely or slightly shorter than the last two joints united, third scarcely longer than fourth. Pronotum one-third broader than long in the middle, transversely impressed somewhat behind the middle, without a distinct apical collar, gradually a little narrowing from base to a little beyond middle, then roundedly more strongly narrowing to apex, laterally not sinuate, the laminately depressed

lateral margins distinctly dilated inwardly at the transverse impression, the basal margin almost straight. Scutellum as long as broad, in the basal half with a triangular elevation, which is depressed or impressed in the middle and emits an often very indistinct keel to the apex. Elytra reaching slightly (female) (in the male, a little farther) beyond apex of abdomen, clavus with three rows of punctures, the commissure less than half the length of scutellum, corium with two rows of punctures near the claval suture and with the radial vein finely punctured, the costal margin straight in its basal fourth, then a little roundedly ampliate, apical margin straight, much shorter than the claval suture. Metasternal orificium a simple curved slit; posterior angle of metapleura acute. Abdomen with the last dorsal segment apically almost straight, or very slightly rounded in the male, sinuate in the female; posterior, sublateral, glandular spot of the fourth ventral segment placed before the middle not far behind the anterior spot; sixth female ventral segment occupying little more than the apical fourth of the venter, genital segment small in both sexes. Fore coxæ armed with a small spine in front near the base; fore femora strongly incrassated, thickest in the basal half, beneath with a groove extending from the apex to not far from the base and terminated on each side by a row of small acute spines, the anterior row with a longer spine nearer to apex than to base; fore tibiæ in both sexes rather strongly curved, not denticulate beneath; first joint of hind tarsi about twice as long as the others united.

Length, exclusive of membrane, male, 4.2 to 5.8 millimeters; female, 4.8 to 5.8.

LUZON, Benguet, Baguio; Laguna, Los Baños and Mount Maquiling. MINDANAO, Dapitan.

In quite fresh specimens the posterior part of the anterior pronotal lobe, the scutellum, the pale basal streak to the clavus, and the pale apical spots to the corium are covered with a bluish gray bloom. This beautifully ornamented insect seems to be common on Mount Maquiling.

Whether this and the following species really belong to *Faelicianus* Dist. is impossible to know with certainty from his inadequate description, which fits several other genera; but as the type of *Faelicianus* in the coloring (except that of the legs) is similar to *F. exilicornis*, I think I have interpreted the genus correctly. It was hitherto known only from Celebes. Distant places it near *Rhyparochromus* Curt., but to this genus it has only a superficial resemblance, being in fact closely related to *Eremocoris* Fieb. and *Scolopostethus* Fieb. (*Manatanus* Dist.).

From the former it differs in having the space between the eyes and the base of the antennæ much shorter than the eye, from the latter in the first antennal joint being produced much more beyond the apex of the head, from both in the narrower vertex and the absence of the two (or four) exserted setæ on it, in the structure of the rostrum and the scutellum, in having the spinulous part of the fore femora extended farther toward the base, and the fore tibiæ not denticulated beneath in either sex. In the above description of *F. summus* I have supplemented the necessary generic characters.

Faelicianus exilicornis sp. nov.

Glabrous, black; the depressed lateral margins of the prothorax, a sublateral spot to the posterior pronotal lobe, an almost percurrent streak to the clavus (subinterrupted behind the middle), and the basal part of the corium as far as to the level of the scutellar apex and including the corresponding part of the epipleura luteous; posterior part of corium fuscous with a luteous spot at the interior apical angle and a similar costal spot almost opposite the other but placed a little farther back, membrane pellucid tinged with testaceous; antennæ, rostrum, and legs testaceous, all coxæ and trochanters, front femora (except apex), and base of middle and hind femora black; finely but rather deeply and very thickly punctulate, somewhat less finely so on posterior pronotal lobe and corium, abdomen impunctate. Head with the bucculæ a little raised, antennæ slender, second joint very slightly incrassated toward apex, fourth not thicker than third. Pronotum one-half broader than long in the middle, laterally scarcely sinuate behind the middle, the depressed lateral margins narrow and not at all dilated inwardly at the transverse impression, the hinder lobe very distinctly shorter than the fore lobe. Elytra (male) very slightly passing apex of abdomen.

Length, male, 4.5 millimeters.

PALAWAN, Puerto Princesa.

Apparently allied to *F. luteicornis* Walk., but with the rear lobe of the pronotum distinctly shorter than the front lobe, scarcely sinuate pronotal lateral margins, and differently colored legs. From *F. summus* it is at once distinguished by the thicker and deeper (though not coarser) punctation, the more slender and one-colored antennæ, the narrower and at the transverse impression not inwardly dilated pronotal lateral margins, and the quite different coloration of the membrane and four posterior legs.

***Lethaeus quadripunctatus* sp. nov.**

Elliptical, subopaque, piceous black, but viewed obliquely from above with a slight brassy luster, the oblong node at the pronotal humeral angles, some small obscure specks here and there on the corium, lateral margins of prosternum and epipleura of corium dark ferruginous, a dot on inner claval vein before its middle and on cubital vein of corium in a line with scutellar apex whitish, membrane subolivaceous black, its veins here and there tinged with whitish; antennæ and rostrum brownish testaceous, first antennal joint fuscous, fourth with a pale yellowish annulation in the basal half; legs black, tibiæ and tarsi brownish testaceous. Head as broad as half the basal width of pronotum, a little broader than long, impunctate both above and beneath, anteocular part distinctly longer than eyes, clypeus somewhat longer than juga, antennæ more than half the length of the body, first joint passing apex of head by more than half its length, second not quite twice the length of first, third slightly shorter than second, fourth subequal to third, rostrum reaching middle of third ventral segment, first joint a little passing anterior margin of prosternum. Pronotum without a distinct collar and not transversely impressed on disk, coarsely and not very densely punctate, with a broad transverse impunctate area in the apical half, and a fine impressed longitudinal median line in the basal half, lateral margins narrowly carinate, almost straight, but somewhat rounded near apex, basal margin straight. Scutellum almost plane, rather coarsely and sparsely punctate, more finely and thickly so near base. Corium thickly punctate, median vein simple, arising from middle of radial vein. Pectus coarsely and rather thickly punctate, more thinly so on propleura, posterior border of metapleura impunctate, evaporative area small, much narrower than the remaining part of the metapleura, extending outward just beyond apex of orificium, its outer margin somewhat rounded. Abdomen beneath extremely superficially punctate. Front femora beneath near apex with two setæ, but not spinous. (Hind tarsi wanting.)

Length, female, 6.4 millimeters; width, 2.5.

LUZON, Laguna, Mount Maquiling.

Resembling some Palæarctic and Ethiopian species of the genus.

***Lethaeus breviceps* sp. nov.**

Oval, subopaque, black, posterior half of pronotum, scutellum,

and elytra pitchy brown with a few small indistinct speckles, part of the veins, a faint fascia before apical angle of corium, its epipleura, and male genital segment dark testaceous; antennæ and rostrum testaceous, first antennal joint and apical half of fourth piceous; legs piceous, tibiæ paler in hue, tarsi testaceous. Head as broad as half the basal width of pronotum, much broader than long, densely and finely transversely rugulose, each ocellus placed in a small smooth area narrowly connected with that of the other side along basal margin of head, anteocular part a little longer than the rather small eyes, clypeus somewhat longer than juga, antennæ half the length of the body, first joint passing apex of head by more than half its length, second a little longer than first, third a little over half the length of second, fourth subequal to second, rostrum reaching middle coxæ, first joint almost reaching base of head. Pronotum with a distinct collar terminated posteriorly by a curved impressed line, not transversely impressed on disk, rather thickly punctate, more finely so on the cicatrical areas, in the center with a short and fine keel not nearly reaching base and apex, lateral margins distinctly though narrowly laminate, almost straight but a little rounded at apex, basal margin slightly rounded. Scutellum plane, rather coarsely and moderately thickly punctate. Corium rather thickly and deeply punctured, median vein straight and simple, but very weak or almost obliterated, arising a little behind middle of radial vein. Pectus coarsely and irregularly punctate, posterior border of metapleura punctate, evaporative area a little narrower than the remaining part of the metapleura, extending outward a little beyond apex of orificium, its outer margin a little rounded. Abdomen beneath almost impunctate. Front femora beneath in the basal half with two or three very small and slender spinelets, toward apex with a few setæ; first joint of hind tarsi about twice longer than the other put together.

Length, male, 4 millimeters; width, 1.6.

LUZON, Laguna, Mount Banahao.

I know of no species nearly allied to this.

Lethaeus retusus sp. nov.

Narrowly elliptical, shining, black or pitchy black, apex of clypeus, pronotal collar and posterior lobe, and male genital segment reddish testaceous, posterior pronotal lobe tinged with piceous in the center, corium and clavus stramineous, their puncturation and a subbasal, median, and apical spot to mesocorium piceous, apical half of exocorium together with the adjacent

exterior border of the mesocorium also piceous, but interrupted somewhat before the apical angle by an irregular curved stramineous fascia connecting the costal margin with the apical margin, clavus with two short oblong spots paler in hue, membrane amber-yellow, a few small spots and on each side before apex a large spot piceous; antennæ, rostrum, and legs testaceous, last antennal joint (except base) fuscous, hind tibiæ pale castaneous. Head large and rather plump, a little broader than long, almost two-thirds as broad as basal width of pronotum, very finely and thickly punctate above and beneath, but each ocellus placed in an impunctate area, anteocular part a little longer than the large eyes, roundedly acutangular, clypeus very slightly longer than juga, antennæ more than half the length of the body, first joint passing apex of head by about half its length, second double the length of first, third slightly shorter than second, fourth subequal to third, rostrum somewhat variable in length, extended to base of third or even fifth segment. Pronotum rather deeply and transversely impressed almost in or very slightly before the middle, lateral margins almost straight, narrowly laminated, with an upright seta near the apical angles, posterior lobe finely and rather thickly punctulate with piceous and with a narrow elongate smooth sublateral callosity, basal margin slightly rounded in front of scutellum, anterior lobe sparingly and extremely finely punctate, with a distinct collar that is terminated behind by a deeply impressed somewhat curved line. Scutellum finely and thickly punctate, with a percurrent, Y-shaped, almost impunctate convexity. Corium with seriate punctation, only apical half of exocorium confusedly punctured, median vein straight and simple, arising from beyond middle of radial vein and running rather near and almost parallel to it, clavus with the second row of punctures ending in the third nearly opposite scutellar apex. Pectus, excepting the smooth posterior border of the metapleura, coarsely and thickly punctate, more sparingly and irregularly so on the propleura, evaporative area extended outward considerably beyond apex of orificium, as broad as remaining portion of metapleura, its outer margin straight. Abdomen beneath very obsoletely and superficially punctate. Front femora in the apical half with a row of slender spines; first joint of hind tarsi a little less than twice the length of the others together.

Length, male, 4.2 to 4.5 millimeters; width, 1.5 to 1.6.

LUZON, Laguna, Mount Maquiling. PALAWAN, Puerto Princessa.

Allied to *L. notabilis* Dist., but with much longer rostrum, somewhat different color markings, etc.

Lethaeus maquilingsensis sp. nov.

Elongately elliptical, shining, black; pronotum with a transverse, pale yellow basal spot on each side before base of clavus; lateral margins of pronotum, clavus, basal half of corium and an area at its inner apical angle, and male genital segment dark testaceous; a broad diffuse fascia immediately behind middle of corium and a triangular spot occupying its outer apical angle piceous, two oblong spots to clavus and an irregular, sub-triangular, inwardly narrowing costal spot before apical angle of corium stramineous, membrane infuscated, less so at apex; antennæ fuscous, second joint (except apex) testaceous, base and apex of third joint pale yellowish (fourth wanting); rostrum brownish testaceous; legs piceous, fore and middle tibiae and all tarsi testaceous. Head a little broader than half the basal width of pronotum, nearly as long as broad, thickly and very finely punctate above and beneath, each ocellus placed in an impunctate area, antecular part a little longer than the large eyes, roundedly acutangular, clypeus slightly longer than juga, antennæ more than half the length of the body, first joint passing apex of head by more than half its length, second one-half longer than first, third equal to second, rostrum reaching base of third ventral segment. Pronotum rather deeply, transversely impressed a little before the middle, lateral margins straight, narrowly laminated, with an erect seta near the apical angles, posterior lobe finely and rather thickly punctate with a narrow, slightly raised, median carina, evanescent before the base; basal margin a little rounded in front of scutellum, anterior lobe sparingly and extremely finely punctate, with a collar that is terminated behind by an impressed line distinct only toward the sides, being obsolescent in the middle. Scutellum with a percurrent, Y-shaped, almost impunctate callosity, finely and sparsely punctate on the lateral areas, more thickly so between the anterior branches of the callosity. Corium moderately thickly punctate, median vein simple, arising from behind middle of radial vein. Pectus coarsely and thickly punctate, a transverse area to propleura and posterior border of metapleura impunctate, evaporative area extended outward beyond apex of orificium, reaching middle of metapleura, its outer margin straight. Abdomen beneath distinctly and sparsely punctulate, male genital segment vertically impressed behind. Front femora, in their median part, with a row of four bristles arising

from very minute granules, near apex with four spines, the first (proximal) of which is longer than the others; first joint of hind tarsi at least two and one-half times longer than the others united.

Length, male, 6 millimeters; width, 2.

LUZON, Laguna, Mount Maquiling.

Allied to the preceding species, but much larger and—apart from the color-differences—with differently constructed antennæ, less sharply defined pronotum, longer posterior pronotal lobe and hind metatarsus, distinctly punctured venter, differently armed front femora, etc.

Lethaeus robustus sp. nov.

Broadly elliptical, opaque above, black, lateral margins of pronotum, two transverse spots to collar, the short median pronotal keel, an oblique slightly curved vitta extended from the humeral angles, gradually somewhat deviating from the margins, to a little beyond middle of pronotum, a fascia uniting these vittæ, posterior angles of propleura, three short streaks to clavus (two near middle, the third near scutellar apex), exterior vein and commissure of clavus, veins of corium, some slight mottlings near middle of exocorium, an oblong irregular spot in basal half of mesocorium, and epipleura of corium ochraceous, a broad anteriorly sinuate costal spot behind middle of exocorium, a smaller subapical spot in outer apical cell of mesocorium and some mottlings in its inner apical cell white, all ochraceous and white macular markings punctate with black, membrane dark ochraceous, largely suffused with fuliginous, veins black, the second dirty whitish in its curved basal part; antennæ fuscous-black, first joint at base and extreme apex testaceous, apical two-thirds of third joint white (fourth wanting); rostrum ochraceous, last joint pale castaneous; legs black, tibiæ (except their spinules) and tarsi ochraceous, apex of tibiæ and of tarsal joints a little brownish. Head a little longer than broad, narrower than half the basal width of pronotum, finely and thickly punctate above and beneath, each ocellus placed in a rather large irregular impunctate area inclosing a small punctulate areolet immediately within the ocellus, anteocular part more than twice longer than the rather large eyes, its apical process conical with straight margins, acutangular (about 60°); clypeus somewhat raised and convex, conspicuously longer than juga, antenniferous tubercles seen from the side moderately declivous, distance between eyes and base of antennæ more than half the length of the eyes, first joint of antennæ passing apex

of head by a little over half its length, second about one-third longer than first, third somewhat shorter than first, rostrum reaching middle of third ventral segment, first joint somewhat longer than head. Pronotum rather strongly narrowed from base to apex, with a shallow, rather indistinct, transverse impression somewhat before the middle, lateral margins narrowly reflexed, a little sinuate at the transverse impression, basal margin straight in front of scutellum, anterior lobe finely and thickly punctate, its disk with an oblique, smooth impression on each side, and a small rounded impression in the middle, the coarsely and sparsely punctured collar very distinct, terminated behind by a deeply impressed rather strongly curved line, posterior lobe coarsely and somewhat sparsely punctate, with a short longitudinal median ridge in its anterior part. Scutellum plane, coarsely and sparsely punctate. Elytra with their costal margins parallel through the basal third of corium, then a little ampliately rounded, clavus in addition to the usual rows of coarse punctures with a few stray impressed points between the posterior halves of the second and third rows, corium coarsely and moderately thickly punctate, more sparingly so in the white spots, the median vein arising behind middle of mesocorium with two basal branches, a shorter one from the radial and a longer one from the cubital vein, after the junction of the branches, slightly curved outward, the two outer veins (third and fourth) of the membrane united by two cross veins. Pectus coarsely and somewhat sparsely punctate, metapleura much more thickly punctate, but their posterior borders very sparingly so, evaporative area extended outward somewhat beyond apex of orificium, but conspicuously narrower than the remainder of the metapleura, its outer margin a little rounded. Abdomen beneath densely and finely strigulose and, moreover, thinly, finely, and superficially punctulate. Front femora armed with a few spines near apex; the spines of all tibiae shorter than the tibial diameter; first joint of hind tarsi more than twice longer than the other joints together.

Length, female, 9.5 millimeters; width, 3.8.

LUZON, Laguna, Mount Maquiling.

This remarkable species differs from the others known to me by the rather long acute head, less declivous antenniferous tubercles, and therefore greater distance between eyes and base of antennae, pronotum from base to apex more strongly narrowed with sinuate lateral margins, and posteriorly more ampliate costal margin of corium; in its general aspect it is also very unlike the typical forms of *Lethaeus*. Yet some of the known

species in one or another character form distinct transitions to *L. robustus*. Judging from the insufficient description by Walker and the still poorer one by Distant, *L. descriptus* Walk. seems to be somewhat allied to *robustus*, although my species has a much longer rostrum, and differs in several other details.

The genus *Lethaeus* now comprises species with or without a transverse discal impression on the pronotum, with or without a pronotal collar, with or without a Y-shaped elevation to the scutellum, and species with a simple as well as with a basally two-branched median vein to the corium. These discordant characters at first sight seem of too much importance to be merely specific, being in many cases common to a natural group of two or more species, but are in my opinion not of generic value owing to the many transitional forms. The entire assemblage of groups and isolated species is bound together by ties that render dismemberment difficult and unsatisfactory.

Some authors have described species of *Lethaeus* said to have triseriately punctate clavi, but I suspect they have regarded the outermost (fourth) claval series of punctures as belonging to the corium. This fourth series is in *Lethaeus* (and several other genera) always separated from the third by an elevated interstice (or vein), and the true demarcation line between clavus and corium, which in *Lethaeus* lies outside the fourth series, is often in the smaller Myodochinæ exceedingly fine and difficult to see, being perceptible only under a very strong lens. To get a correct conception of the true external limit of the clavus in the smaller forms it must be remembered that the corium has typically but two regular rows of punctures near the claval suture; if there are seemingly three such rows, we can with very little risk of mistake assume that the third (innermost) row really belongs to the clavus. "Clavo seriebus quattuor punctorum instructo" is one of Stål's generic characters of *Lethaeus*, and I have seen no member of this genus with the punctures of the clavus arranged in three rows.

Genus *PTYCHODERRHIS* novum

Body oblong. Head inserted to the eyes, triangular, broader than long, as broad as half the basal width of pronotum, ocelli placed very close to the eyes and antenniferous tubercles immediately before the eyes, *gula longitudinally convex, tumid*, antennæ about half the length of the body, first joint passing apex of head by half its length, rostrum reaching hind coxæ, *first joint* as long as head and a little longer than first antennal joint, *owing to the convex throat not appressed to the underside*

of the head in its whole length, the apical part always being considerably distant from the head. Pronotum almost trapeziform, much broader than long, not or very obscurely transversely impressed, a little narrowed from base to apex, where it is a little broader than the head, apical margin straight, apical angles with an exserted seta, lateral and basal margins not depressed, almost straight or very slightly rounded. Scutellum scarcely convex. Clavus with three rows of punctures, the commissure less than half the length of the scutellum; corium with the straight apical margin shorter than the claval suture, radial vein in its apical half deviating from the costal margin, ending abruptly somewhat behind middle of corium, exocorium and mesocorium, owing to the shortness of the radial vein, broadly confluent in their apical parts; membrane with a deeply impressed transverse fold near the base, the next inmost vein curved very strongly inward in its basal part. Fourth ventral segment with three sublateral, glandular spots, the hindmost of which is placed near the posterior margin. Front femora in both sexes a little incrassated, in their apical half armed with two very short and fine spinules; middle and hind tibiæ with scattered bristlelike spines; hind tarsi more than half the length of tibiæ, first joint about twice the length of the others combined.

Type of the genus, *Ptychoderrhis bipunctata* sp. nov.

The characters distinguishing this genus from either *Antilocoris* Kirk. or *Tropistethus* Fieb., or from both these genera, are printed in italics.

To this genus also belong *Aphanus indicus* Dallas, *Tropistethus antennatus* Scott, and *Tropistethus simulans* Distant. Distant has also referred the first-mentioned of these three species to *Tropistethus*, but they cannot be confounded with this Palearctic genus, in which (apart from other important differences) the pronotum is distinctly bilobed and laterally sinuate and in which the forelegs are sexually highly different in structure, whereas they are identically constructed in both sexes of *Ptychoderrhis*. The new genus seems to be more related to *Antilocoris*, in which, however, the body is broader and more oval and the pronotum subcampanulate, its lateral margins being strongly (and usually broadly) rounded anteriorly, gradually passing into the apical margin so that the pronotum at the apex is considerably narrower than the head. Furthermore the throat is straight in *Antilocoris*, permitting the first rostral joint to be strictly applied to it in its whole length, and the radial vein of the corium is percurrent (although sometimes weaker toward the end) and subparallel to the costal margin.

The subbasal plica of the membrane in *Ptychoderrhis* is often even more conspicuous than in *Lethaeus* Dallas and in *Cistalia* Stål, with which it also has the strongly curved second vein of the membrane, and the number and arrangement of the glandular spots of the fourth ventral segment in common. In fact the genus must be placed near *Cistalia*, if we follow Stål's system.

Ptychoderrhis indica Dall.

LUZON, Laguna, Los Baños and Mount Maquilang.

Of this species only the unique type specimen was previously known, but it does not seem to be rare in the Philippines. The single, not quite normally colored, specimen of it known to me in 1913 was redescribed by me as a new species under the name *Antilocoris banksii*. The great superficial resemblance between these two genera is a rather meager excuse for this mistake.

Ptychoderrhis bipunctata sp. nov.

Black, humeral angles and basal margin of pronotum narrowly pallescent, corium and clavus whitish, subpellucid, punctured with fuscous, the former with a small round spot behind middle at apex of radial vein, the apical margin and a short posterior vitta at claval suture fuscous, membrane hyaline, iridescent, with the exterior half of the transversely triangular impressed basal area fuscous, male genital segment pale testaceous; antennæ with the two first joints testaceous, third fuscous, fourth whitish testaceous with the extreme base fuscous; rostrum and legs pale testaceous, all coxæ and fore femora (excluding apex) picescent. Impunctate, basal half of pronotum and scutellum irregularly and extremely finely punctulate, corium finely and moderately thickly punctate. The first three antennal joints subequal in length, fourth longer than any of the others. Scutellum distinctly longer than broad.

Length, male, 2.5 millimeters.

LUZON, Benguet, Baguio.

About the size and form of *Ptychoderrhis antennata* Scott; quite different from the other three species in the coloring of the elytra.

Lemnius bakeri sp. nov.

Glabrous, black; corium with a triangular ochraceous patch behind the middle, membrane whitish hyaline; antennæ, rostrum, legs, and male genital segment dark testaceous, coxæ and trochanters black, femora piceous. Head as broad as apex of pronotum, thickly and finely punctate, the eyes not quite touch-

ing pronotal apical margin. Pronotum two and a half times broader at base than at apex, neither transversely impressed nor foveately sulcate, coarsely and thickly punctate, but with the cicatrical areas finely and sparingly punctulate, the carinate lateral margins very slightly sinuate behind the middle, separated from the disk by a regular row of punctures. Scutellum coarsely and thickly punctate, the basal area a little less thickly so, the Y-shaped carination smooth. Elytra slightly passing apex of abdomen. Pleura coarsely and thickly punctate. Abdomen beneath smooth and impunctate, the segmental sutures deeply impressed, the glandular spots of the fourth segment very small. Fore and middle femora beneath before apex with short rigid setæ, hind femora with about five such setæ; tibiæ sparsely set with slender bristlelike spines, which are much less conspicuous in the front pair; hind legs rather long, their femora reaching apex of abdomen, their tarsi slightly longer than half the length of the tibiæ, the first joint not quite two times longer than the others combined.

Length, male, 3.2 millimeters.

LUZON, Laguna, Los Baños.

A well-marked species, not easily confounded with the type of the genus. Breddin¹¹ gave, in his usual excellent way, a re-description of the genus *Lemnius* Dist. and described a new species, *L. inornatus*. Distant later placed *inornatus* as a synonym of *L. ovatus* Dist., thus indirectly admitting that his description of the genus (the "cruciform" scutellar carination, the "straight" apical margin of the corium, etc.) was quite wrong in several points, and his figure faulty. Apart from the corrections made by Breddin, the antennæ are represented in Distant's figure as inserted midway between the eyes and the apex of the head, whereas they really are inserted immediately before the eyes. The genus is allied to *Coracodrymus* Bredd., with which it has several particulars in common.

Rhodiginus pullatus sp. nov.

Black, covered with an extremely short dusty grayish pubescence, somewhat less than the basal half of corium, especially in its interior part, pale cinereous, remainder of corium either entirely fuscous or somewhat variegated with testaceous, membrane hyaline; antennæ testaceous, first joint and apex of second whitish; rostrum testaceous, basal joint piceous; legs whitish testaceous. Head very thickly and finely punctulate,

¹¹ *Deutsche Ent. Zeitschr.* (1907), 209.

second joint of antennæ scarcely or slightly longer than first, third as long as first, fourth longer and thicker than any of the others. Pronotum with the anterior lobe punctulate the same as the head, posterior lobe and scutellum a little less finely and less thickly punctate. Elytra slightly passing the apex of abdomen. Pectus and venter extremely finely and thickly punctulate.

Length, female, 2.3 to 2.5 millimeters.

LUZON, Laguna, Los Baños; Tayabas, Malinao.

Readily distinguished from *R. dispar* Walk., the only other known species of the genus, by the structure and the coloring of the antennæ, the entirely black pronotum, and the differently colored corium.

The original description of the genus *Rhodiginus* Dist. is inadequate, but Breddin has supplemented it with many essential characters.¹²

Lispochroa laeviuscula sp. nov.

Shining, black; humeral angles of pronotum and the adjacent part of its lateral margins obscurely testaceous, elytra whitish or flavo-testaceous; corium with a broad, irregular, more or less diffuse, piceous median fascia or transverse spot, which often occupies the greater part of posterior half of corium; membrane whitish testaceous, suffused or variegated with fuscous, apex of abdomen often pitchy brown; antennæ testaceous, base of first joint and fourth (often also third) piceous; rostrum and legs pale testaceous, often more or less suffused with piceous. Head very finely punctulate above, with a few exserted hairs, antennæ as long as head, pronotum, and scutellum together, first joint very slightly passing apex of head, second a little longer than or subequal to third, fourth as long as or somewhat longer than third. Pronotum mostly impunctate, only toward the sides with some scattered punctures, strongly transversely convex in its anterior half, the apical collarlike lobe with the impressed line terminating it posteriorly, distinct toward the sides but obliterated in the middle, where this area is subconfluent with the disk, the subacute lateral margins of the pronotum roundly inflected at the base of the apical collar and discontinued there, leaving the parallel sides of the collar vertically bluntly rounded; an upright seta arising from the margin somewhat behind the collar. Scutellum finely and sparsely punctate and with a row of small punctures close to the lateral margins, the basal mar-

¹² Ibid. (1907), 210.

gin smooth. Elytra finely and seriatly punctate, the row on the corium next to the claval suture, the basal part of the adjacent row, and the three claval rows more coarsely impressed, commissure of clavus somewhat shorter than scutellum. Abdomen beneath with fine scattered recumbent hairs easily coming off, the suture between the third and fourth segments very weak or indistinct.

Length, male, 2.3 millimeters; female, 2.5.

Macropterous form.—Pronotum distinctly narrowed from the base of the postcollar inflection; elytra reaching a little beyond apex of abdomen, apical margin of corium straight, membrane longer than broad.

Brachypterous form.—Pronotum very slightly narrowed from the base to the postcollar inflection; elytra (female) reaching middle of last dorsal segment, apical margin of corium rounded, the interior part of this margin touching that of the other corium behind the claval commissure, membrane crescent-shaped, short but well defined, about twice broader than long, distinct to the very apical angle of the corium.

LUZON, Laguna, Mount Maquiling.

The body of the female is higher and more robust than that of the male. The above description of the pronotum includes some generic characters.

Differs from *L. tartarea* Dist. by smaller size, much less pilose body, shorter antennæ, much less punctured pronotum, a little longer elytra in the brachypterous form with more developed membrane, and finer and more seriate punctation of the corium. From *L. blandula* Bredd. it is distinguished by the much less punctate pronotum, etc.

In a paper sent for publication some time ago, but not yet published, I have expressed the supposition that the genus *Lua* would prove to have a macropterous form, and I now find that *Lua* Dist. (1909) represents the brachypterous form and *Lispochroa* Bredd. (1907) the macropterous form of the same genus. Breddin's excellent and detailed description leaves no room for doubt as to this synonymy. *Lispochroa tartarea* is specifically distinct from *blandula* by the pilose body, longer second antennal joint, and coarser, thinner, and less seriate punctation of the corium. Distant placed the genus near *Xestocoris* V. Duz. (*Rhaptus* Dist. nec Stål), but it is more related to *Lispolophus* Bergr., near which it should be placed, as suggested by Breddin.

***Agunga compactilis* sp. nov.**

Glabrous, subopaque, black; a small lateral spot to pronotum at its transverse impression, clavus (except the punctate striæ), the subbasal part of the corium as far as to the level of the scutellar apex, a round costal spot behind middle of corium, another round spot opposite the former near inner apical angle of corium, and a more or less interrupted narrow vitta between the two round spots whitish; membrane also whitish, but the apical half somewhat infuscated, the veins fuscous; rostrum and legs black, tibiæ fuscous, their apex and the tarsi testaceous; thickly and very finely punctate, corium seriatelately and much less punctulate, venter alutaceous. First joint of rostrum not quite reaching base of head. Front lobe of pronotum one-third longer than the hind lobe. Elytra reaching apex of abdomen.

Length, male, 2.5 millimeters.

LUZON, Benguet, Baguio.

Allied to *A. crassa* Dist., but smaller and with quite differently colored legs.

In the single specimen I have seen, the fourth antennal joint was lacking, and the second and third were destroyed by an accident before I had described them, but as far as I remember, they were constructed and colored much as *A. crassa*; the first antennal joint is pale brownish in its basal half, the rest being stramineous.

To the generic characters of *Agunga* Dist. should be added: Head more than twice broader than long, vertex four times broader than an eye, ocelli very far apart, antenniferous tubercles convergent, rounded exteriorly, basal joint of rostrum longer than first antennal joint; pronotum with the carinate lateral margins obtusely angled a little behind apex, their apical part being obliquely truncate behind the eyes; clavus with triseriate punctation, the two exterior rows placed extremely close to each other, the commissure more than half the length of scutellum, claval suture longer than apical margin of corium; fourth ventral segment with two sublateral, glandular spots placed near each other in the anterior part of the segment.

Genus ENTISBERUS Distant

Entisberus DISTANT, Ann. & Mag. Nat. Hist. (1908), VII, 11, 74;
Fauna Brit. Ind., Rhynch. (1903), 2, 66.

Body oblong. Head much broader than long, strongly declivous (60°), seen from the side conically produced obliquely

downward, its apex lying considerably below the level of the sternum, eyes of moderate size, sessile but strongly prominent, their greatest part laterally projecting beyond apical angles of pronotum, vertex about twice broader than an eye, antenniferous tubercles placed immediately before the eyes, first joint of antennæ as long as head, passing its apex by two-thirds the length of the joint, second joint subequal to first, third a little shorter, fourth subequal to third, bucculæ very short, rostrum reaching a little beyond front coxæ, first joint not reaching base of head, half the length of first antennal joint, second joint subequal to first and a little longer than third. Pronotum somewhat constricted at the transverse impression, with a distinct depressed apical collar, carinate lateral margins, and the basal margin shortly sublobately depressed in front of corium, but otherwise of different structure in the two sexes; in the male transversely impressed behind the middle, with the posterior lobe slightly sloping, the anterior lobe but little narrower, globosely convex with its basal part horizontal, the middle part strongly rounded, the apical part perpendicularly declivous, and the lateral margins strongly rounded; in the female transversely impressed in the middle, with the posterior lobe much more sloping, the anterior lobe considerably narrower, forming together with the posterior lobe a continuous, moderately sloping (about 45°), slight convexity and with the lateral margins less rounded. Scutellum subequilaterally triangular with a furcate carination, the anterior branches of which are strongly divergent, forming a more or less obtuse angle, straight or hooked at their end. Elytra a little passing apex of abdomen, clavus triseriately punctate, its commissure less than half the length of scutellum, apical margin of corium straight (not "slightly rounded" as described and figured by Distant), shorter than claval suture, membrane with the two inner veins in their basal half placed close together and rather strongly curved inward, third vein visible only in its apical half, fourth starting from apical angle of corium, forming a very strong curvature inward and in its basal half separated from the second vein by a wide space, fifth vein usually obliterated. Fourth ventral segment with the two sub-lateral glandular spots placed in the anterior part of the segment. Legs simple, front femora not incrassate, unarmed, first joint of hind tarsi as long as the other joints together.

As Distant has omitted some of the most striking characters of the genus, it has been necessary to redescribe it. The length of the membrane is correctly described by him, but he figures it as not reaching apex of abdomen. The specimen figured by

him seems to be a female, and he probably knew only one sex, as he says nothing of the strong sexual differences in the structure of the pronotum.

***Entisberus archetypus* Distant.**

Entisberus archetypus DISTANT, Ann. & Mag. Nat. Hist. (1903), VII, 11, 74; Fauna Brit. Ind., Rhynch. (1903), 2, 66.

LUZON, Laguna, Los Baños, Mount Maquiling, and Paete.
MINDANAO, Davao.

The antennæ, as described by Distant, are "pale stramineous," but the first joint is always blackish at the base; the fourth joint is somewhat thickened, but by no means "globose" as described by Distant. The membrane is pellucid, shaded with brownish and variegated with fuscous; the veins are usually whitish.

Previously known only from Ceylon; in the Philippines it seems to be a common insect.

Breddin has united the genus *Entisberus* with *Pamera*, but in this he was totally mistaken. The new species described by him under the name *Pamera (Entisberus) subsericea* is an ordinary *Pamera* and has nothing to do with *Entisberus*.

Genus DUDIA novum

Body oblong. Head a little broader than long and broader than apex of pronotum, rather strongly declivous (45°), seen from the side conical, eyes prominent, vertex about three times broader than an eye, antenniferous tubercles placed immediately before the eyes, first joint of antennæ half the length of the head, slightly passing its apex, second one-half longer than first, clavate at apex, third somewhat shorter than second but a little longer than first, fourth subequal to third, bucculæ very short, rostrum reaching middle coxæ, first joint reaching base of head, a little longer than first antennal joint, second joint a little longer than first, third subequal to first. Pronotum broader than long and a little over twice broader than head, rather strongly narrowed from base to apex, transversely impressed a little behind the middle where it is somewhat constricted, collar narrow, posterior lobe a little sloping, its basal margin slightly rounded, anterior lobe transversely and longitudinally highly convex, its apical half strongly declivous, the lateral margins obtuse, a little rounded. Scutellum broader than long, convex. Prosternum seen in profile angularly sinuate, separated from anterior lobe of pronotum by a narrow, smooth, subimpressed line. Metapleura with acute posterior angles. Elytra reach-

ing a little beyond apex of abdomen, the narrow clavus with two rows of punctures, costal border of corium somewhat reflexed, apical angle acute, apical margin straight, a little shorter than claval suture, venation of membrane much as in *Entisberus*, but median (third) vein entirely wanting and fourth less curved. Fourth ventral segment with the sublateral glandular spots as in *Entisberus*. Front femora slightly incrassated, in the apical half armed with a spine and between the spine and the apex with a few extremely small teeth. Tibiæ one-half longer than tarsi. First joint of hind tarsi a little longer than the other joints together.

Allied to *Entisberus* Dist., but with differently constructed antennæ, rostrum, scutellum, and front femora, and with no sexual differences in the structure of the pronotum. Like *Entisberus* it is an aberrant genus of Stål's division *Lethaearia*.

Type of the genus, *Dudia comptula* sp. nov.

Dudia comptula sp. nov.

Black, a costal spot to corium before the middle, a smaller costal spot behind its middle, inner basal angle of membrane, an oval spot near this angle, and a pyriform spot on each side near apex of membrane (rarely also a short apical streak to clavus, three small spots near apical margin of corium, and two small additional spots to membrane) white; antennæ brown, apex of the three first joints whitish; rostrum testaceous; legs black, tarsi pale testaceous; glabrous, thickly and finely but rather deeply punctate, still more finely so on the head, venter impunctate with a fine recumbent pilosity.

Length, male and female, 2.3 to 2.8 millimeters.

LUZON, Laguna, Mount Maquiling.

This fine little gem of a bug seems to be common on Mount Maquiling. Very rarely the ground color of the corium is fuscous and the venter pale castaneous.

Navarrus phaeophilus Walk.

LUZON, Laguna, Mount Maquiling. PALAWAN, Puerto Princessa. Previously known from Ceylon and Celebes.

Navarrus Dist. is a very distinct genus of the division *Cleradaria*. Distant describes the first rostral joint as "reaching or slightly passing eyes," and in his figure this joint is represented as only reaching the middle of the anteocular part of the head, while the second joint reaches the middle of the eyes. In reality the first joint reaches the anterior, and the second joint the posterior, margin of the eyes.

Genus **HARMOSTICTA** new name

As pointed out by Breddin the division *Cleradaria* is more related to Stål's *Lethaearia* than to any other division of the subfamily *Myodochinae*; and the genus *Edulica*, although correctly placed in the *Cleradaria* by Distant, forms a distinct transition to the *Gastrodaria* (*Lethaearia*) by the first rostral joint, which almost reaches the base of the head. The name *Edulica* being preoccupied by *Edulica* Hampson, 1901, in *Lepidoptera*, I propose for *Edulica* Distant the name *Harmostica*.

HETEROGASTRINÆ***Sadoletus valdezi* sp. nov.**

Oblong, black; posterior lobe of pronotum ochraceous, with two broad pale brownish (sometimes dark fuscous) percurrent vittæ, separated by a narrow pale line; apical half (or at least apex) of scutellum castaneous with a pale median line; corium and clavus whitish, membrane hyaline, a spot on fore and middle acetabula and apical callus of orificia ferruginous; abdomen often castaneous, male genital segment rufescent in the middle; antennæ and rostrum testaceous, the former with the fourth and often also the third joint fuscous, legs whitish testaceous, tibiæ entirely, or at least above, and last two tarsal joints infusate; body (including corium) clothed with a short, deciduous, golden sericeous pubescence, more thickly so on upper side of head and anterior pronotal lobe. Head a little narrower than base of anterior pronotal lobe, second joint of antennæ twice the length of first, rostrum reaching middle coxæ. Pronotum with a faint transverse impression before the middle, anterior lobe a little narrowed from base to apex, posterior lobe about twice the length of anterior lobe, thickly and finely punctured with brown. Corium and clavus with fine fuscous punctation, the uniseriately punctate basal part of the exocorium much shorter than the biseriately punctate apical part, in which the interstice between the two rows of punctures is plane, not elevated. Pectus sparsely punctate. Front femora in the apical half with a very small (sometimes wanting) spine.

Length, male, 3.5 millimeters; female, 3.8.

Male.—Sixth ventral segment in the middle as long as the two preceding ones together; genital segment rather small, as broad as half the basal width of scutellum.

Female.—Third, fourth, and fifth ventral segments with straight apical margins, as long in the middle as at the sides; sixth segment as long as fifth, except in the middle, where it

has an acute median incision for the reception of the median basal part of the small genital segment, which is twice broader than long.

LUZON, Laguna, Mount Maquiling and Mount Banahao.

Allied to *S. validus* Dist., but smaller, with black head and anterior pronotal lobe, quite differently colored legs, etc. Named for Julian Valdez, Professor Baker's collector.

Sadoletus bakeri sp. nov.

Oblong-subovate (female), black, posterior lobe of pronotum, apical third of scutellum, fore acetabula and apical callus of orificia tawny, scutellar keel ochraceous, clavus and a little more than basal half of corium white, membrane hyaline, abdomen castaneous, sixth ventral segment and genital segments fulvous; antennæ and rostrum fuscous; legs castaneous, coxæ piceous, all trochanters and basal half of middle and hind femora whitish testaceous, first joint of tarsi (except extreme apex) white; densely clothed with a short golden sericeous pubescence, less thickly so on venter, and with the cicatrical areas and posterior lobe of pronotum, apical half of scutellum, and elytra glabrous. Head as broad as base of anterior pronotal lobe, second joint of antennæ twice the length of first, rostrum reaching middle coxæ. Pronotum constructed and punctured as in *S. valdezi*, the pale median line of the posterior lobe slightly elevated, evanescent toward the base. Scutellum with fuscous punctation in the apical half. Corium and clavus with fine fuscous punctation, the corial costal margins straight and parallel through somewhat less than the basal half, then (at least in the female) slightly ampliately rounded, the uniseriately punctate basal part of the exocorium subequal in length to the biseriately punctate apical part, in which the interspace between the exterior and interior rows of punctures is elevated, with a short additional row of punctures outside the middle part of the inner row, apical margin of corium very conspicuously shorter than claval suture. Pectus sparsely and rather coarsely punctate. Front femora in the apical half with a very small toothlike tubercle.

Length, female, 4.8 millimeters.

Female.—Ventral segments constructed as in *Sadoletus valdezi*, but apical margin of sixth segment straighter, with an inconspicuous acute incision in the middle, the small genital segment more than twice broader than long.

Male.—Unknown.

LUZON, Laguna, Mount Banahao.

A somewhat robust, very distinctive species.

Sadoletus voluptarius sp. nov.

Oblong (male), black, basal margin of pronotum, clavus, and somewhat more than basal half of corium white, posterior angle of metapleura tinted with the same color, membrane hyaline, tinted with brownish between the two outer veins, a spot on fore acetabula and apical callus of orificia ferruginous; antennæ wanting; rostrum piceous, legs black, all trochanters, somewhat less than basal half of middle and hind femora, and first joint of all tarsi (except extreme apex) yellowish white; clothed with a short, silvery sericeous pubescence easily coming off; posterior pronotal lobe, apical half of scutellum, and elytra glabrous. Head as broad as base of anterior pronotal lobe, rostrum reaching middle coxæ. Pronotum with a very distinct transverse impression before the middle, anterior lobe slightly narrowed from base to apex, posterior lobe one-half longer than anterior lobe, thickly and finely punctate, with a fine percurrent median keel. Corium and clavus with fuscous punctation, costal margin (at least in the male) almost straight, exocorium constructed and punctured as in *S. bakeri*, apical margin of corium much shorter than claval suture. Pectus sparsely and rather coarsely punctate. Fore femora near base of apical half with one or two spines.

Length, male, 5 millimeters.

Male.—Abdomen beneath finely keeled in the middle from its base to apex of fourth segment, sixth segment in the middle as long as the three preceding ones together; genital segment large, broader than half the basal width of scutellum.

Female.—Unknown.

LUZON, Laguna, Mount Banahao.

Apparently allied to *S. corvus* Dist., but larger, pronotal posterior lobe without the pale median line, and legs differently colored. Further comparison is impossible owing to Distant's utterly inadequate description.

Sadoletus montanellus sp. nov.

Oblong (male), black, apex of scutellum brown, clavus and somewhat more than basal half of corium whitish, membrane hyaline; antennæ and rostrum dark ferruginous, third antennal joint fuscous, fourth blackish, legs pitchy brown, all trochanters, basal half of middle and hind femora, and first joint of all tarsi whitish testaceous; clothed with a short, deciduous, silvery sericeous pubescence; posterior pronotal lobe, apical half of scutellum, and elytra glabrous. Head slightly broader than base of anterior pronotal lobe, second joint of antennæ not quite twice

the length of first, rostrum reaching middle coxæ. Pronotum with a distinct transverse impression in the middle, the two lobes being of equal length, anterior lobe slightly narrowed from base to apex, posterior lobe finely and rather densely punctate, with a very fine median keel. Corium and clavus with fine fuscous punctation, the uniseriately punctate basal part of the exocorium as long as the biseriately punctate apical part, in which the interstice between the two rows of punctures is elevated, apical margin of corium considerably shorter than claval suture. Pectus sparsely and rather coarsely punctate. Fore femora near the middle with a very small spine.

Length, male, 3 millimeters.

Male.—Sixth ventral and genital segments constructed as in *S. valdezi*.

Female.—Unknown.

LUZON, Laguna, Mount Banahao.

Somewhat allied to the preceding species, but much smaller, with the two pronotal lobes of equal length, and the legs with a paler ground color.

Sadoletus montivagus sp. nov.

Oblong (male), black, clavus and somewhat more than basal half of corium white, but the black of the posterior part of corium extended more forward at the costal margin, reaching the middle of the latter, membrane hyaline; antennæ dark brown (fourth joint wanting, probably black), rostrum dark testaceous, legs black, first joint of tarsi (except extreme apex) white; underside of body, head also above, middle of anterior pronotal lobe, and basal half of scutellum clothed with a dense and short, deciduous, silvery sericeous pubescence, remaining parts of body glabrous. Head a trifle broader than base of anterior pronotal lobe, second joint of antennæ not quite twice the length of first, rostrum reaching hind coxæ. Pronotum with a distinct transverse impression before the middle, anterior lobe very slightly narrowed from base to apex, posterior lobe one-half longer than anterior lobe, thickly and deeply, but rather finely, punctate. Corium and clavus with fine blackish punctation, the uniseriately punctate basal part of the exocorium subequal in length to the biseriately punctate apical part, in which the interstice between the exterior and the somewhat irregular partly subduplicate interior row of punctures is a little raised, the radial vein from near its base to the beginning of the black-colored part gradually callously dilated and ivory white, apical

margin of corium conspicuously shorter than claval suture. Pectus sparsely punctate. Front femora unarmed or almost so.

Length, male, 3.2 millimeters.

Male.—Sixth ventral and genital segments constructed as in *S. valdezi*.

Female.—Unknown.

LUZON, Laguna, Mount Banahao.

At once distinguished from the preceding species by the structure of the pronotum and radial vein, the differently colored legs, etc.

Sadoletus vulvatus sp. nov.

Oblong, black; four transverse spots on basal margin of pronotum (the outermost spot on each side placed before base of elytra), a triangular spot near costal margin of corium a little before the middle, a triangular spot on corium near the claval suture a little behind its middle, and an anteriorly sinuate wedge-shaped spot occupying the apical angle of corium white; subcallose and impunctate, membrane hyaline, sixth ventral and genital segments of female ferruginous; antennæ and rostrum pitchy black, legs black, first joint of tarsi (except extreme base and apex) whitish testaceous; a lateral band on vertex close to the eyes and underside of body clothed with a short, thick, deciduous; silvery sericeous pubescence, remaining parts of body glabrous. Head a little broader than base of anterior pronotal lobe, above very thickly rugulosely punctulate, second joint of antennæ twice the length of first, last joint of rostrum entirely passing base of venter. Pronotum with a rather deep transverse impression before the middle, anterior lobe slightly narrowed from base to apex, very thickly and finely subrugulosely punctate with a few very small transverse smooth areas, posterior lobe one-half longer than anterior lobe, thickly and rather coarsely punctate with a percurrent median keel. Corium and clavus somewhat coarsely punctate, inner apical area of mesocorium almost impunctate, the uniseriately punctate basal part of the exocorium subequal in length to the apical part, in which the broad interstice between the exterior and interior row of punctures is scarcely elevated but irregularly subseriately punctate, apical margin of corium considerably shorter than claval suture. Pectus moderately thickly and rather coarsely punctate. Front femora in the apical half armed with a spine.

Length, female, 4.2 millimeters.

Female.—Third, fourth, and fifth ventral segments extremely

strongly sinuate and contracted in the middle, being actually broadly bisected by the very long sixth segment, which is extended forward to the apical margin of the second segment and is three times longer in the middle than at the sides, apical margin of sixth segment broadly and somewhat deeply sinuate, genital segment rather large, broader than long, and less than half the length of the sixth segment.

Male.—Unknown.

LUZON, Laguna, Mount Banahao.

The four white transverse spots of the pronotal basal margin are possibly more or less confluent in some specimens.

This remarkable species in the structure of the female venter is so different from the other species of which the female is known to me, that its relationship to them at first sight seems almost incredible. Yet the difference, although involving the greatest part of the venter, is solely due to the excessive development of the sixth segment, also found in some other genera of the Heterogastrinae. *Sadoletus vulvatus* is unquestionably congeneric with *S. valdezi* and *bakeri*, the stated sexual difference notwithstanding, and some of the species of which only the male is known to me may prove to be intermediate in the structure of the female venter.

Of the genus *Sadoletus* Dist. only two species from India and one from Borneo were hitherto known. The occurrence of six species on Mount Banahao alone is noteworthy and seems to point to the Philippines as the headquarters of the genus, but its species are apparently very rare; of five of the species here described I have seen but a single specimen.

To the generic characters of *Sadoletus* should be added: Head beneath with a percurrent channel for reception of the first rostral joint, second joint of antennae about double the length of first, third shorter than the adjacent joints, fourth subequal to or a little longer than second. Scutellum with the basal half finely punctate, the apical half coarsely punctate with a median keel sometimes extended forward beyond the middle. Corium with the interstice between the two innermost rows of punctures from before or near middle gradually widening to near apex, then tapering to the apex, the row of punctures terminating the interstice exteriorly being angularly bent a little before apex and directed obliquely inward, meeting the interior row at the apex, apical half of the interstice with a short row of punctures; clavus triseriately punctate, its commissure about one-fourth the length of scutellum; membrane with only three veins, the inner and the outer veins arising from a common stem near the inner

basal angle, the outer vein in its basal part parallel to the basal margin, then rotundately bent and proceeding to the apex, the straight median vein arising from near base of outer vein.

In Distant's figure of the type the membrane is represented as having two basal cells. This is indubitably due to faulty tracing of the veins, which are somewhat indistinct in certain specimens.

The front femora are usually armed with one or two spines beneath, but this character cannot be relied on, as the spines are often very feebly developed or wanting.

Some of the distinctive characters of the six Philippine species may be summarized thus:

Key to the Philippine species of Sadoletus.

- a'. Corium entirely whitish, its apical margin but slightly shorter than the claval suture, the uniseriately punctate basal part of the exocorium much shorter than the remaining part. Femora whitish testaceous.
valdezi sp. nov.
- a'. Corium not entirely whitish, its apical margin very distinctly shorter than the claval suture, the uniseriately punctate basal part of the exocorium subequal in length to the remaining part. Femora not, or not entirely, whitish testaceous.
- b'. Corium whitish, somewhat less than apical half black. Rostrum not reaching base of venter.
 - c'. Pronotum not entirely black. Larger species (about 5 millimeters).
 - d'. Posterior lobe of pronotum nearly twice the length of anterior lobe, tawny, brown-punctured. Scutellum black with tawny apical part and ochraceous median keel. Ground color of legs castaneous bakeri sp. nov.
 - d'. Posterior lobe of pronotum one-half longer than anterior lobe, black with white basal margin. Scutellum entirely black. Ground color of legs black voluptarius sp. nov.
 - c'. Pronotum entirely black. Small species (about 3 millimeters).
 - e'. The two pronotal lobes of equal length. Radial vein of corium not dilated in its basal half. Femora pitchy brown, basal half of the middle and hind pair whitish testaceous.
montanellus sp. nov.
 - e'. Posterior pronotal lobe one-half longer than anterior lobe. Radial vein of corium gradually callosely dilated in its basal half. All femora entirely black montivagus sp. nov.
- b'. Corium black with three white spots. Rostrum passing base of venter.
vulvatus sp. nov.

Hyginus kinbergi Stål.

LUZON, Laguna, Los Baños and Mount Maquiling; Tayabas, Malinao. MINDANAO, Butuan.

This species (with which *H. semperi* Stål and *consputus* Stål must be united) is common in the Philippines and is extremely variable. The upper side of the head is more or less declivous

and the rostrum, which often only reaches the base of the venter, is in other specimens extended far beyond its middle; the metatarsus of the hind legs is also variable in length.

Hyginus signifer Walk.

LUZON, Laguna, Los Baños and Mount Maquiling.

Previously known only from Ceylon.

Artemidorus myrmecodes sp. nov.

Black; apex of scutellum, clavus (excluding base and apex), the adjacent margin of corium (more or less distinctly), a median fascia to corium connecting its inner apical angle with the costal margin, lateral margins of the female abdomen (except sixth segment), an oblong lateral spot at apex of second, a subquadrate lateral spot at apex of fourth and the lateral border of fifth female abdominal segments, a median broadly triangular spot on third female ventral segment, more or less extended forward over the second one, and a more or less distinct spot on the acetabula white; membrane hyaline with a very broad black median fascia; antennæ black or dark fuscous, first joint white toward base; rostrum black, apical two-thirds of second and the whole third joint testaceous; legs black, inner (anterior) side of front femora ferruginous, all of trochanters (except their apices) and base of middle and hind femora white, tarsi brownish or fuscous; coarsely and thickly punctate, more finely so on upper side of head, corium only with the ordinary seriate punctation, abdomen impunctate; head above, pronotum, and scutellum rather longly and densely erectly pilose, venter sparingly so, corium with a very short but rather thick erect pubescence visible only from the side, the white median fascia of the corium, underside of head, prosternum, pleura, and apical part of venter more or less densely clothed with a silky silvery pilosity, a very thick similar pilosity forming an oblique fascia on each side of venter between apical lateral part of second segment and middle of third segment, in the female connecting the white spots at these places. Head almost as broad as base of pronotum, second joint of antennæ about twice the length of first, third conspicuously shorter than second and longer than fourth. Pronotum distinctly longer than broad. Scutellum with the median keel anteriorly ending in a transverse elevation placed a little behind the base, apex subcallose. Elytra considerably constricted before middle, clavus with black punctation. Legs longly erectly pilose, hind femora slightly passing apex of abdomen, gradually narrowing from the middle to the base, first joint of hind tarsi a little over two times longer than the others together.

Length, male, 7.3 millimeters; female, 8 to 8.5.

Male.—Abdomen slightly broader than the closed elytra, apical angles of fourth and fifth segments a little prominent.

Female.—Abdomen considerably broader than the closed elytra, apical angles of fourth and fifth segments not prominent.

Variety (male).—First antennal joint, a subbasal annulation to second joint, forelegs (except coxæ and trochanters), middle femora (except base), apex of hind femora, and first joint of middle and hind tarsi ferruginous.

LUZON, Laguna, Mount Maquiling.

A very distinct species, remarkable by its myrmecoid aspect and also reminding one of the mirid genus *Pilophorus*. The only male I have seen belongs to the above-described variety.

In another periodical¹⁸ I have given the differential characters of the closely allied genera *Hyginus* Stål and *Artemidorus* Dist. Distant correctly places *Hyginus* (with its synonym *Hyginellus* Dist.) in the Heterogastrinæ, but still refers *Artemidorus* and *Nerthus* Dist. (another synonym of *Hyginus*!) to the Colobathristidæ!

HENICOCEPHALIDÆ

Henicocephalus bakeri sp. nov.

Fuscous, pronotal apical lobe and center of median lobe paler, postocular part and underside of head ferruginous, base of elytra ochraceous, abdomen dingy testaceous, last segment above and beneath and female genital segment dark fuscous, the other segments between middle and lateral margins above with a transverse, beneath with an oblique, fuscous spot; antennæ somewhat variable in color, first joint testaceous but often infuscated, second always fuscous, third testaceous or fuscous, fourth pale testaceous, sometimes with the base fuscous, rostrum testaceous, legs fuscous; coxæ, trochanters, base of femora, knees, apex of tibiæ, and tarsi testaceous; thickly but shortly pubescent, lateral margins of abdomen with longer exserted hairs, antennæ, rostrum, and legs pilose. Head as long as pronotum, posterior lobe a little broader than long and as broad as the width across the eyes (female), laterally strongly rounded, vertex in the female four times broader than an eye, antennæ as long as head and apical pronotal lobe together, first joint reaching apex of head, second as long as the distance between apex of antenniferous tubercles and the postocular constriction, third a little shorter than second, fourth subequal to second. Pronotum a

¹⁸ *Ent. Mitt.* (1914), 3, 360.

little broader than long, with almost straight basal margin, median lobe a little more than twice the length of apical lobe, with a \perp -shaped central impression and a tripartite impression on each side, in the female one-fifth narrower than the basal lobe. Scutellum convex. Elytra not quite reaching apex of abdomen. Legs short and stout, fore tibiae at apex almost as broad as femora in the middle, hind femora scarcely longer than fore femora.

Length, female, 5 millimeters.

LUZON, Laguna, Los Baños and Mount Maquilang.

Somewhat resembling *H. basalis* Westw., but smaller and distinct in several details.

Systelloderes capillicornis sp. nov.

Depressed, castaneous (including antennae), posterior margin of ventral segments narrowly testaceous; rostrum and front legs brownish testaceous, middle and hind legs whitish. Head shining, as long as pronotum, with very few short upright hairs, eyes (male) occupying almost the whole height of the head, vertex (male) between the eyes two and a half times broader than an eye, gular interspace between the eyes much narrower than an eye, posterior lobe of head broader than long with slightly rounded sides, antennae about as long as head and pronotum together, first joint shortly oval, glabrous, reaching apex of head, second joint slightly incrassated from base to apex, as long as the width of vertex with one eye, finely pilose, the last two joints very slender, capillary, set with rather long exserted hairs, the third half as long again as second, fourth subequal to third, rostrum pilose. Pronotum shining, very sparingly and shortly pilose, more distinctly so at the lateral margins, considerably broader than long, strongly widening from apex to base where it is four times broader than at apex, lateral margins not sinuate between apical and median lobe, but distinctly constricted between median and basal lobe, basal margin broadly and rather deeply arcuately sinuate, apical lobe longer in the middle than at the sides owing to the transverse impression terminating it posteriorly being obtusangularly produced backward, median lobe minutely sculptured in the center, basal lobe at the middle of its apical margin with a small transverse callosity. Scutellum as long as pronotum in the middle, shorter than broad, with some extremely short and subtle hairs, opaque, but with a highly polished and slightly elevated T-shaped figure reaching the apex. Elytra reaching apex of abdomen, strongly iridescent, in their apical half considerably broader than pro-

notum, radial sector angular, not strongly upturned toward apex, the common basal stem of the median and cubital veins short, a little exceeding basal fourth of elytron, the single cross vein of the median area placed nearer to base than to apex of elytron. Abdomen flattened, laterally thinly ciliated with rather long hairs. Legs compressed, thinly pilose, front femora above arcuately dilated, the inferior margin straight, front tibiæ at apex as broad as femora in the middle, hind femora subequal in length and shape to fore femora but a little narrower, reaching middle of venter, hind tibiæ slightly dilated from base to apex, inner claw of front tarsi much longer than outer claw.

Length, male, 2.8 millimeters.

LUZON, Laguna, Los Baños.

This is the first Asiatic species of the genus. It is chiefly represented in the Neotropical Region, but one species occurs in North America and one in Europe; I also know an Australian species.

No representative of this family was previously known from the Philippine Islands.

NABIDIDÆ

Aristonabis reuteri sp. nov.

Head, anterior pronotal lobe, prosternum, and abdomen luteous; lateral border of the last tinted with red, scutellum, elytra (including membrane), meso- and metastethium, a sub-lateral vitta to venter extended through the three last segments and gradually strongly widening backward, and female genital segment black; apical collar and posterior lobe of pronotum, posterior angle of propleura, and posterior costal area of corium (much widened toward the apical margin) sanguineous; basal border of membrane whitish; first antennal joint testaceous with narrowly fuscous apex, second black, third fuscous, paler toward apex, fourth very pale testaceous; rostrum testaceous, second joint tinted with reddish; legs pale sanguineous; coxæ, trochanters, and tarsi luteous; shortly, palely villose, impunctate, but the transverse impressions of the pronotum rather coarsely and concolorously punctate. Head with the anteocular part but slightly narrowed toward the rounded apex, first joint of antennæ glabrous, the incrassate second joint a little longer than width of head across the eyes, pilose, the last two joints longly pilose, third distinctly shorter than second, a little narrowed from base to apex, fourth subequal in length to third, rostrum shortly and sparingly pilose. Pronotum about one-third broader than

long and at base four times broader than at apex, anterior lobe twice broader than head, posterior lobe subequal in length to anterior lobe (including collar) and two-thirds broader than it. Legs shortly pilose.

Length, female, 4.8 millimeters.

MINDANAO, Iligan.

Allied to *A. elegantulus* Schum., but much smaller, with quite differently colored corium and clavus.

Aristonabis poppiusi sp. nov.

Sanguineous; elytra (including membrane), mesostethium, and metastethium black; corium with a pyriform white spot at the apical margin; first antennal joint reddish, second dark fuscous, third and fourth brownish testaceous; rostrum reddish testaceous; legs sanguineous, tarsi luteous; shortly palely villose, impunctate. Head with the anteocular part a little narrowed toward apex, first joint of antennæ glabrous, the incrassate second joint as long as width of head across the eyes, pilose, the last two joints longly pilose, third distinctly shorter than second, sublinear, fourth as long as third. Pronotum nearly twice broader than long and at base five times broader than at apex, anterior lobe two and a half times broader than head, posterior lobe almost as long as anterior lobe (including collar) and two-thirds broader than it, without an impression near the humeri. Legs sparingly shortly pilose.

Length, female, 4 millimeters.

LUZON, Laguna, Mount Maquiling.

Very distinct from any of the four other known species of the genus.

MIRIDÆ

CYLAPINÆ

Peritropis poppiana sp. nov.

Elliptical, opaque, black with the following ochraceous markings: On upper side of head two slightly curved transverse lines in the basal part and five longitudinal lines, of which the next outmost on each side is furcate anteriorly; on pronotum all margins (narrowly), two sublateral lines on each side (the inner one abbreviated), numerous minute discal mottlings, and some transverse subconfluent lines in the basal part; on scutellum two oblique basal spots, a short lateral vitta, apex, and many small discal points; on clavus the inner and commissural margins and three lines, of which the inmost (excluding its basal part) is much broader than the others and the median percurrent,

reaching apex of clavus; on corium a discal vitta, two lines on each side of the vitta, the apical margin, numerous points to embolium and cuneus, and apical margin of embolium; on pectus apical margin of prosternum, an oblique propleural line, posterior margin of mesopleura, a small metapleural spot, and orificia; on venter a small spot near basal angles of the segments and their extreme apical margin; the ochraceous markings of corium and clavus consist of minute scales; epipleura of corium fawn-colored, its exterior margin blackish, finely dotted with whitish, the veins black, margined on each side with whitish; wings sublacteous, pellucid; antennæ from their base to a little beyond middle of second joint ferruginous, the remainder fuscous; rostrum testaceous, toward apex piceous; legs dark fuscous, coxæ and trochanters very pale testaceous, hind femora with a whitish annulation in the apical half, all knees narrowly pallescent, tibiæ at apex and tarsi dark testaceous; body without exserted hairs, only the venter finely and rather thinly and palely pilose. Head as broad as apex of pronotum, eyes large but moderately prominent, seen from above much longer than broad, the space between them not quite two times broader than an eye, antennæ glabrous, the last two joints finely and shortly pilose, first joint distinctly passing apex of head, in length equal to half the width of head, second about three times longer than first and as long as pronotal basal margin, slender but with the apical half slightly thicker than the basal half, third and fourth subequal, each of them longer than first, together one-third shorter than second, rostrum reaching middle of venter. Pronotum trapeziform, longitudinally slightly, transversally more distinctly, convex, two times broader than long and as long as its apical width, lateral margins very narrowly reflexed, humeral angles very narrowly rounded, the calli not produced over the median part of the collar, reaching backward beyond middle of pronotum, separated by a feeble, anteriorly abbreviated impression. Scutellum slightly convex. Elytra (female) much longer than abdomen, commissure of clavus as long as scutellum, cuneus reaching apex of abdomen, about as long as broad, exterior cell of membrane small but distinct. Wings slightly shorter than elytra. Legs subglabrous.

Length, female, 3.1 millimeters, inclusive of membrane, 3.9; width, 1.9.

LUZON, Laguna, Mount Maquiling.

Related to *P. javanica* Popp., but readily distinguished by the structure of the head and the antennæ, much less convex scutellum, and different coloration.

HEBRIDÆ

Hebrus balnearis sp. nov.

Black, basal margin of vertex (laterally curved a little forward between ocelli and eyes) and a short linear spot at anterior angle of eyes pale grayish, a transverse apical area to pronotum lead-colored, the basal two-thirds of clavus and three spots to membrane white, one of these spots being placed near the exterior basal angle, one opposite the first near the interior margin, and one (oblong) behind middle in the median line of the body; underside of head (including bucculæ) and acetabula (excluding a triangular continuation of the black pleural color) pale testaceous; antennæ fuscous, the first two joints (except their extreme tip) testaceous; rostrum castaneous; legs pale testaceous, the knees somewhat infuscated, extreme apex of tibiæ and of tarsi fuscous; head above and pronotum with scattered, extremely short golden hairs, corium with similarly colored but much longer and much more numerous hairs, on scutellum with short erect black hairs, the leaden apical area of the pronotum and the pale markings of the head and clavus glabrous. Antennæ as long as head, pronotum, and scutellum together, the first two joints subglabrous, taken together as long as head, first passing apex of head by half its length, second half the length of first, the last three joints very slender, thread-like, sparsely pilose, third joint slightly shorter than the first two joints united, fourth as long as first, fifth subequal to third. Pronotum laterally strongly sinuate, the shoulders distinctly prominent, subangularly rounded. Scutellum triangular, neither truncate nor notched at apex. Abdomen beneath with a fine, recumbent, whitish pilosity.

Length, female, 2 millimeters.

LUZON, Laguna, Los Baños.

Allied to *H. bengalensis* Dist., but with differently constructed antennæ, laterally more deeply sinuate pronotum, and different color markings of pronotum and elytra. I have seen three females, but no male of this species.

Hebrus rufescens sp. nov.

Ferruginous, head above, down the middle, and posterior half of pronotum a little infuscated; abdomen testaceous; elytra fuscous, basal two-thirds of clavus whitish, membrane with three testaceous spots, one near exterior basal angle, one opposite the first, near interior margin, the third a little behind the middle; antennæ, rostrum, and legs pale testaceous, the knees slightly

infuscated. Antennæ as long as head and pronotum together, the first two joints subglabrous, together shorter than head, first passing apex of head by half its length, second a little shorter than first, the last three joints very slender, filiform, finely and sparingly pilose, third joint somewhat longer than first, fourth slightly shorter than second, fifth subequal to third. Pronotum laterally deeply sinuate, humeri distinctly prominent, subangular. Scutellum triangular, neither truncate nor notched at apex.

Length, male, 1.5 to 1.6 millimeters; female, 1.6.

LUZON, Laguna, Los Baños.

Remarkable by its small size and pale coloration.

Distant has described and figured a Philippine species under the name *Merragata cruciata*, but as he describes the antennæ as five-jointed and also describes the length of each of these five joints, it is clear that this species belongs to *Hebrus*, not to *Merragata* B. White, which has four-jointed antennæ.

There can be no doubt that *Hebrus* Curt. and *Naeogeus* Lap. are identical, and the latter name has been considered to have one year's priority. Agassiz, however, has stated that Laporte's work, although bearing the date 1832, was not published until 1833. There is, therefore, no reason to prefer the name *Naeogeus*.

MESOVELIADÆ¹⁴

Mesovelia vittigera Horv.

Mesovelia vittigera HORVÁTH, Rev. d'Ent. (1895), 14, 160; Ann. Mus. Nat. Hung. (1915), 13, 550.

LUZON, Laguna, Mount Maquiling.

A common species, distributed from Egypt and Syria through the Ethiopian and Indo-Malayan Regions to New Guinea, but not previously recorded from the Philippines. As shown by Horváth in his monograph of this family, *M. orientalis* Kirk., *mulsanti* Dist. (nec B. White), and *proxima* Schout. are synonyms of it.

¹⁴ Berg and other zoölogists have correctly stated that family names derived from generic names ending in *-ia*, must, according to the rules of the Latin language, have the ending *-iadae* (not *-idae*), and the correct ending has been accepted by Meyrick, Reuter, and several other entomologists. There are no exceptions to this linguistic rule; Horváth has recently [Ann. Mus. Hung. (1915), 539] referred to the ancient name *Hesperides* as a proof to the contrary, but the ending *-ides* is not the same as *-idae*, and the cited name does not signify "les filles de Hesperia," as Horváth says, but "the daughters of the West," or of the Night, being derived from the word *Hesperos*.

VELIADÆ

Microvelia atrolineata sp. nov.

Oblong, somewhat narrowed behind, black, beneath with a slight bluish gray pruinescence, head above with a whitish lateral line touching inner margin of eyes and a pale grayish median vitta, pronotum with whitish yellow apical margin and a slightly raised, longitudinal, dull velvet-black median line; elytra with the claval area, a short basal spot, an antemedian, elongate, interiorly rounded, exteriorly straight or subsinuate spot, two submedian spots abreast (the inner one much larger, more oblong, and including a blackish median dash), and an oblong more or less parallel apical spot white; underside of head, front acetabula (sometimes also apex of the other acetabula), lateral margins of abdomen, apical margin of last ventral segment, and genital segment brownish testaceous; antennæ fuscous, first joint testaceous toward the base; rostrum testaceous, last joint pitchy black; legs whitish testaceous, femora in their apical part, tibiæ, and tarsi usually somewhat infuscated. Head without an impressed median line, antennæ a little shorter than head and pronotum together, subglabrous, first joint a little longer than eye, passing apex of head by half its length, second much shorter than first, third equal in length to first, fourth as long as the two preceding joints together. Pronotum considerably broader than long, antehumeral part shorter than the posthumeral process, which is not very broadly rounded at apex, humeral angles distinctly prominent. Elytra reaching apex of abdomen, the veins well pronounced. Pleura with some short recumbent silvery hairs. Abdomen not broader than the closed elytra, connexivum very narrow, strongly reflexed. Legs subglabrous; fore tibiæ much shorter than femora, fore tarsi a little over half the length of tibiæ; hind femora not quite reaching apex of abdomen.

Length, male and female, 1.7 millimeters.

LUZON, Laguna, Los Baños and Mount Maquiling.

Allied to *M. singalensis* Kirk., but with nonsulcate head and differently constructed antennæ.

GERRIDÆ

HALOBATINÆ

Rhagadotarsus kraepelini Bredd.

Rhagadotarsus kraepelini BREDDIN, Mitt. Nat. Mus. Hamb. (1905), 22, 187.

LUZON, Laguna, Los Baños.

A rare, but widely distributed insect, new to the Philippine

Islands. It has been redescribed by Distant under the name *Nacebus dux*. The differences in "the structure of the head and thorax," alleged by Distant to exist between his and Bredin's genus and species, are not evident to me. He has probably not understood Bredin's description, which is written in German. Distant's description, although not quite exact in all details, is better than usual, but his statement "rostrum reaching the intermediate coxæ" is quite wrong. The rostrum is never so long in any gerriid, the distance between the fore and middle coxæ being very long in this family. In *Rhagadotarsus* the rostrum is extended somewhat beyond the fore coxæ, but does not by far reach the middle coxæ.

ACANTHIADÆ

Acanthia balnearum sp. nov.

Oblong-oval (male) or oval (female), including elytra a little over two times (male) or not quite two times (female) longer than broad, subglabrous, black; exocorium (excepting two spots behind the middle, one in the embolium and the other in the adjacent area, and apical margin of embolium), one spot before and five spots behind middle of mesocorium, a (sometimes indistinct) subapical spot to clavus, and extreme apical margin of ventral segments white; apical border of last female segment broadly whitish, apical margin of head narrowly testaceous, membrane whitish, sometimes a little smoky here and there, the three interior cells with a blackish spot behind the middle, the veins fuscous-black; antennæ fuscous-black, first, and sometimes second, joint very obscurely testaceous; rostrum piceous or dark testaceous; legs whitish testaceous, coxæ and extreme apex of tibiæ and of tarsal joints blackish, femora often more or less infuscated in their apical half; very slightly shining, more so beneath, clavus and in fresh well-preserved specimens corium (excluding exocorium and the white spots) quite dull, velvet-like. Head considerably broader than apex of pronotum, antennæ about half the length of body (including elytra), without exerted hairs, first joint scarcely as long as the shortest distance between the eyes, second less than twice the length of first, third slightly shorter than second and a little longer than fourth. Pronotum three times broader than long in the middle and about one-half broader than head, apical margin slightly shorter than the almost straight lateral margins, the transverse impression in its median part distinctly more distant from apical than from basal margin, the anterior lobe with a transverse median fovea.

Scutellum about as long as median length of head and pronotum together, the transverse impression placed in the middle. Elytra much longer than abdomen, impunctate, clavus and corium with scattered, extremely short, golden hairs easily rubbed off, embolium in the male slightly passing apex of abdomen, in the female reaching the apex of the protruding ovipositor. Sixth female ventral segment as long as the three preceding segments together, broadly rounded at apex, covering the genital segment and the basal half of the ovipositor. Hind tibiae armed with scattered, short, dark, bristlelike spines; second and third tarsal joints of equal length.

Length, male and female, 2.4 millimeters; including elytra, male, 3.4, female, 3.

Variety.—The white embolium with black base, but without the postmedian black spot, the adjacent area of the exocorium black with an oblong basal spot and an oval subapical spot white, mesocorium with only two or three postmedian white spots.

LUZON, Laguna, Los Baños.

A true *Acanthia*, the first one from the Philippines.

Bredden¹⁵ has redescribed the Indian *Salda dizoni* Dist. as belonging to *Chartoscirta* Stål, but this is certainly a mistake. There is nothing either in Distant's description and figure or in Bredden's redescription indicative of a *Chartoscirta*, and it is apparently a true *Acanthia*.

Saldoida bakeri Poppius.

Saldoida bakeri Poppius, Wien. Ent. Zeit. (1914), 32, 52.

LUZON, Laguna, Mount Maquiling.

The specimen from the above locality has the scutellum quite black and is, like the single type from Los Baños, a macropterous female. The last ventral segment in this sex is roundedly produced over the genital segment and the basal half of the ovipositor and is broadly white at apex. The claval commissure (in the macropterous form) is as long as the scutellum. This species differs from *S. armata* Horv., apart from the distinctive characters pointed out by Poppius, by the much more convex scutellum. The geographical distribution of this curious genus—Florida, the Philippines, and Formosa—is very remarkable, but it is probably more widely dispersed in both the Neotropical and the Indo-Malayan Region. Not only are these insects great rarities, but they are difficult to catch on account of their rapid movements.

¹⁵ Arch. f. Naturgesch. (1912), 8, 26.

NOTONECTIDÆ

Helotrophes balnearius sp. nov.

Obovate, above finely and thickly punctulate with fuscous, the punctuation of the head and apical part of pronotum extremely fine and thick, almost concolorous on the head. Head considerably narrower than humeral width of pronotum, seen from before one-third broader than long, the anteocular part a little shorter than the vertical diameter of the eye, vertex over three times broader than an eye, the distance between upper end of eyes and top of head seen in profile much shorter than that between lower end of eyes and apex of head, the triangular acute subgenal appendices directed downward and somewhat backward. Pronotum conspicuously narrowed from the humeral to the apical angles, the lateral margins seen from above straight, seen from the side profoundly arcuately sinuate, the sinuosity reaching upward above the middle of the eye, the uppermost point of the sinuosity being midway between the crown of the pronotum and the lower margin of the sternum so that the sternum is completely visible in the sinuosity, the lateral margins of the pronotum and head forming together a continuous narrow ledge. Scutellum at the base slightly broader than the vertex, the apex subacute. Elytra without a claval suture, passing and deflected over the apex of the abdomen, their exterior base lying considerably above the inferior surface of the body, the lateral margins rather strongly descending from the base to the apex. Abdomen somewhat acclivous toward its posterior end. Color above pale testaceous with the following fuscous markings: A basal fascia to head emitting two narrowly separated vittæ to middle of head, a broad, posteriorly deeply sinuate apical fascia to pronotum behind and confluent with the basal fascia of the head, a narrow basal fascia to scutellum, and numerous irrorationes on basal two-thirds of pronotum (excluding the unspotted basal margin), on scutellum, and on elytra; underside of body piceous; rostrum pitchy testaceous; legs testaceous, tarsi tinged with piceous.

Length, 2.5 millimeters.

LUZON, Laguna, Los Baños.

A species remarkable by the deep lateral sinuosity of the body (as seen in profile). Very distinct from the type of the genus and differing still more from *H. indicus* Dist., but possibly more allied to *H. martini* Kirk., as far as can be judged from Kirkaldy's utterly inadequate descriptions of the species of this genus.

In this genus the head is not independently moveable, being

practically fused with the thorax, forming (as in the Arachnida) a cephalothorax, into the cephalic part of which (rather than into the sternum) the fore legs are fitted. Only above, behind the eyes, there is a faint trace of a short suture, which does not reach the lateral margins. In Distant's figure of *H. indicus* the suture between head and pronotum is represented as distinct and curved forward, rendering the head crescent-shaped, but I doubt very much the exactness of this detail in the drawing. If that suture can be made fully visible by boiling the cephalothorax in a solution of potassium hydrate, I think the suture will prove to be straight, and the limits of the head and pronotum should in the above description be conceived accordingly. In *Helotrephes* there is on each side of the head near its apex a small acutely triangular piece protruding from under the margin of the head. I have called these pieces subgenal appendices, but I have had no opportunity to prove from what part of the head they take their origin. They are not fused with the genæ, as represented in Stål's and Distant's figures.

CORIXIDÆ

Micronecta quadristrigata Bredd.

Micronecta quadristrigata BREDDIN, Mitt. Nat. Mus. Hamb. (1905), 22, 156.

LUZON, Laguna, Los Baños.

Hitherto known only from Java, where it is common. Bredin's excellent description renders its identification easy. It is generally a little smaller than the Philippine *M. vanduzeei* Kirk., the pronotum is longer, the mesoxypus is subacute, and the claws of the middle tarsi are shorter.

In the paper where Kirkaldy described the above-mentioned species he also gave a list of the exotic species of *Micronecta* known up to that date, but he omitted the East African *M. hydroporina* Gerst. (1878) and the Philippine *M. proxima* Leth. (1877). Distant¹⁰ describes two species under the names *M. thelxinae* Kirk. and *M. memonides* Kirk.; but these names are printer's errors, corrected in the author's separate copies, the correct names being *thelxinoe* and *mnemonides*.

¹⁰ Fauna Brit. Ind., Rhynch. (1910), 8.

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THE MEGACHILID BEES OF THE PHILIPPINE ISLANDS

By T. D. A. COCKERELL

(University of Colorado)

The present account is entirely based on a very fine series of specimens sent by Professor C. F. Baker and on the comparatively few published records that existed prior to the formation of the Baker collections. Several islands are represented, but of course our knowledge of the bee fauna of the Philippines is still very incomplete. In the case of the Megachilidæ, many of which nest in wood, it is very likely that some of the species have been distributed through the agency of man and do not belong to the original fauna of localities where we now find them.

The genus *Ctenoplectra* Smith, which Ashmead included in the Megachilidæ, is an isolated type not at all referable to that family. The one Philippine species is *C. vagans* Cockerell.¹ Baker obtained it on Mount Maquiling. It will be readily known by the two submarginal cells and the shining blue abdomen. The lateral ocelli are more or less aborted. The Philippine genera of Megachilidæ, all of which have only two submarginal cells in the anterior wings, are readily separable as follows:

*Key to the Philippine genera of the Megachilidæ.**

Eyes hairy; female abdomen usually conical or pointed at end, male abdomen spinose at end; parasitic bees, without pollen-collecting apparatus.

Coelioxys Latreille.

Eyes not hairy..... 1.

1. Female like *Megachile*, but wholly without ventral scopa, and antennæ 13-jointed *Androgynella* Cockerell.

Female with a ventral scopa (pollen-collecting brush) on abdomen..... 2.

¹ *Ann. & Mag. Nat. Hist.* (1904), VII, 14, 204, and (female) (1914), VIII, 13, 280.

2. With yellow or reddish tegumentary markings; foot with a pulvillus, or pad, between the claws..... *Dianthidium* Cockerell.
Without pale tegumentary markings..... 3.
3. Very small bees, with a pulvillus between the claws; face with no protuberance; ventral scopa white..... *Heriades* Spinola.
Larger bees; or, if small, without any pulvillus..... 4.
4. Marginal cell sharply pointed at end; face, in female, with a protuberance, end of male abdomen pointed..... *Lithurgus* Berthold.
Marginal cell obtuse at end; end of male abdomen variously formed; no pulvillus on foot *Megachile* Latreille.

Genus COELIOXYS Latreille

These bees are parasitic in the nests of *Megachile*. The species at present known from the Philippines are separable thus:

Key to the Philippine species.

- Very large, the female about 22 millimeters long; head with fulvous pubescence; wings very dark..... *ducalis* Smith.
Under 20 millimeters, but female at least 13 millimeters; face with a median keel; hair of head white, at most slightly stained with fulvous.
philippensis Bingham.
- Much smaller 1.
1. Females 2.
 - Males 4.
 2. Apex of abdomen obtuse..... ?
Apex of abdomen produced, acute..... *genalis* Cockerell.
 3. Apical ventral plate of abdomen truncate; thorax above with fulvous hair markings *manila* Ashmead and *bakeri* Cockerell.
Apical ventral plate subangular, emarginate; markings on thorax white.
oothura Cockerell.
 4. Legs red; pubescence fulvescent... *manila* Ashmead and *bakeri* Cockerell.
Legs black..... 5.
 5. Punctures of mesothorax extremely dense; two bright hair spots at base of scutellum *luzonicus* Cockerell.
Punctures of disk of mesothorax distinctly separated..... 6.
 6. Mesothorax anteriorly with a conspicuous fulvous triangle of hair.
bakeri var. *atripes* Cockerell.
Mesothorax without such a triangle..... 7.
 7. Tegulae black or piceous..... *genalis* Cockerell.
Tegulae rufous; very small, a little over 6 millimeters long.
dapitanensis Cockerell.

Coelioxys ducalis Smith.

Coelioxys ducalis SMITH; COCKERELL, Ann. & Mag. Nat. Hist. (1914), VIII, 13, 146.

Bingham gives a colored figure of this species.²

LUZON, Laguna, Los Baños (*Baker*). Friese describes a subsp. *flavipennis* from Celebes.

² Fasciculi Malayenses, Zoology (1905), 3, Pl. A.

***Coelioxys philippensis* Bingham.**

Coelioxys philippensis BINGHAM, Ann. & Mag. Nat. Hist. (1895), VI, 16, 439.

The unusual form of the specific name must be maintained as printed. I examined Bingham's type in the British Museum.

LUZON, Laguna, Los Baños and Mount Maquiling (*Baker*).

***Coelioxys bakeri* Cockerell.**

Coelioxys bakeri COCKERELL, Entomologist (1915), 108.

MINDANAO, Iligan, Dapitan, and Davao (from *Baker*). Type from Iligan.

***Coelioxys bakeri* var. *atripes* var. nov.**

Legs black. Male from Los Baños, Luzon (*Baker*).

***Coelioxys manilæ* Ashmead.**

Coelioxys manilæ ASHMEAD, Canadian Entomologist (1904), 36, 281; COCKERELL, Proc. U. S. Nat. Mus. (1909), 36, 415.

Ashmead's description is poor, but I saw his type a number of years ago in Washington and found the last dorsal segment of abdomen to be broadly rounded and obtuse, as in *C. bakeri* female. *Coelioxys bakeri* appears to differ from *C. manilæ* by the absence of a fulvous triangle on mesothorax, posteriorly, and the surface of the mesothorax shining between the punctures. The legs of *manilæ* are red, as in typical *bakeri*. The male of *manilæ* is unknown, but a male from Mount Maquiling, with the surface of mesothorax dull and red tarsi, but the legs otherwise black, is probably referable to *manilæ*; if not, it is a new species, for it is certainly distinct from *bakeri*.

***Coelioxys genalis* Cockerell.**

Coelioxys genalis COCKERELL, Entomologist (1916), 49, 157.

Originally described from a male from Mount Maquiling. The female (Los Baños, *Baker* 6306) is 9 millimeters long; last dorsal segment of abdomen pointed, its apical half sharply keeled; last ventral pointed, notched at sides, extending beyond dorsal. This differs from the European *C. elongata* in the less-produced and much less parallel-sided last ventral. A female from Davao, Mindanao, is not separable. From Negros I have only a male, and it is separable from a Mount Maquiling male as follows:

Hair bands of abdomen white; superior apical spines farther apart.

Mount Maquiling form

Hair bands of abdomen fulvous; superior apical spines nearer together.

Negros form.

Additional material may indicate that the Negros insect is separable.

LUZON, Laguna, Mount Maquiling, Los Baños. MINDANAO, Davao. NEGROS, Cuernos Mountains. All from Baker.

Coelioxys cothura sp. nov.

Female.—Length, 9 millimeters; black, including the legs, antennæ, mandibles, and tegulæ; eyes brown, with short hair; a shining ridge or line on lower part of front, but none on clypeus, which is minutely granular; hair markings of head, thorax, and abdomen white, slightly stained with ochereous; cheeks densely covered with hair; mesothorax coarsely and closely punctured, with a triangle of white hair in front; scutellum rounded behind, axillar spines short; wings dilute brown; tarsi with fulvous hair on inner side; abdomen shining, the white hair bands linear in middle, broadly expanded at sides, on sixth segment forming a patch on each side; first segment strongly and closely punctured (but punctures smaller than on mesothorax); second with lateral grooves and large, well-separated punctures; third and fourth with smaller punctures and transverse, smooth raised bands; fifth and sixth with extremely minute punctures, but the sixth with large coarse punctures apically; apical end of sixth rounded and obtuse; last ventral extending a little beyond, very broad, subangular and emarginate at end; venter with broad white hair bands on segments 2 to 5, but first segment with only a large median patch, which extends from base to apex. The last dorsal has only a faint indication of a keel.

LUZON, Laguna, Los Baños (*Baker*). By the structure of the end of the abdomen, this is associated with such species as *C. afra*, *C. emarginata*, and *C. hæmorrhœa*.

Coelioxys luzonicus Cockerell.

Coelioxys luzonicus COCKERELL, Entomologist (1914), 118.

LUZON, Laguna, Los Baños (*Baker*).

Coelioxys luzonicus makilingensis Cockerell.

Coelioxys luzonicus makilingensis COCKERELL, Entomologist (1915), 108.

Male a little over 8 millimeters long, differing from typical *luzonicus* thus: Mesothorax anteriorly (but not posteriorly) with a rather large triangle of pure white hair; oblique hair marks on scutellum larger, pure white; spot above posterior end of tegulæ pure white; first recurrent nervure joining second submarginal cell very close to basal corner; upper apical teeth of abdomen longer and not on the same horizontal plane, the inner on each side being higher than the outer, which is not true of

luzonicus. Perhaps a distinct species. The Davao male has brown eyes, the Luzon form has them green.

LUZON, Laguna, Mount Maquiling. MINDANAO, Davao (*Baker 7458*). The spelling of the name must be kept as first printed, following the name of the locality as given on Baker's labels, but Maquiling appears to be the official spelling of the name of the mountain.

Coelioxys dapitanensis Cockerell.

Coelioxys dapitanensis COCKERELL, *Entomologist* (1915), 109.

MINDANAO, Dapitan (*Baker 3152*). PALAWAN, Puerto Princesa (from *Baker*).

Genus DIANTHIDIUM Cockerell

The species of this genus make nests of resin and pebbles.

Dianthidium minutissimum (Bingham).

Dianthidium minutissimum (BINGHAM) COCKERELL, *Entomologist* (1917), 164.

PALAWAN, Puerto Princesa (from *Baker*). *Anthidium javanicum* Friese, from Java, is the same species. Bingham gives a colored figure of this species.³

Genus LITHURGUS Berthold

Lithurgus scabrosus (Smith).

Lithurgus scabrosus (SMITH) MEADE-WALDO, *Ann. & Mag. Nat. Hist.* (1912), VIII, 10, 463.

MINDANAO, Dapitan and Davao. The British Museum has it from Rarotonga, Celebes, and Amboina. The ventral scopa of the female is long and rather thin, black. This is Baker's No. 3135.

Genus MEGACHILE Latreille

These are the leaf-cutting bees; occasionally they are so abundant as to be injurious. The Philippine species are separable as follows:

Key to the Philippine species.

Females	1.
Males	15.
1. Ventral scopa black.....	2.
Ventral scopa paler or red, or only partly black.....	5.
2. Clypeus very short and strongly tuberculate in middle; insect very large, considerably over 20 millimeters long (subgenus <i>Eumegachile</i> Friese)	3.
Clypeus not thus formed.....	4.

³ Fasciculi Malayenses, *Zoology* (1905), 3, Pl. A.

3. Wings dark fuliginous..... cloths Smith.
Wings yellowish tuberculata Smith.
4. Fully 20 millimeters long; wings dark fuliginous; upper edge of clypeus straight atrata Smith and lachesis Smith.
Much less than 20 millimeters long; wings translucent reddish; upper edge of clypeus concave..... davaonensis Cockerell.
5. Over 15 millimeters long, with a large flattened, polished, triangular supraclypeal space bakeri Cockerell.
Under 15 millimeters long; wings never dark fuliginous..... 6.
6. Middle and hind femora red; ventral scopa white or cream-colored, black on last segment..... 7.
Legs black 8.
7. Larger; ocelli very large..... ocellifera Cockerell.
Smaller; ocelli small..... tarsatula Cockerell.
8. Scopa white, black on last two segments; hair on tubercles fulvous; abdomen metallic metallescens Cockerell.
Scopa, at least mainly or largely, ferruginous or orange or yellow..... 9.
9. Abdomen with orange-fulvous hair bands; a shining polished area on upper part of clypeus and lower part of supraclypeal area.
rufofulva Cockerell.
Abdomen with pale (sometimes yellowish) hair bands..... 10.
10. Scopa with hair on last segment at least mainly red..... 11.
Scopa with hair on last segment black..... 12.
11. Larger; abdomen with strong green and purplish tints.
chlorura Cockerell.
Smaller; abdomen not metallic..... hera Bingham.
12. Scutellum with black or dark fuscous hair..... 13.
Scutellum with ochreous or fulvous hair..... 14.
13. Scutellum with long black hair; pale hair of face white.
philippinensis Friese.
Scutellum with shorter black or dark fuscous hair; pale hair of face fulvous; mandibles longer..... valdezi Cockerell.
14. Scutellum with short ochreous or whitish hair; scopa more brightly colored and mesothorax more densely punctured than in valdezi.
subrixator Cockerell.
Similar to subrixator, but tegulae red with black basal spot; face covered with fulvous pubescence; scopa very pale fulvous, black at tip.
robili Ashmead.
15. Abdomen densely covered with orange-fulvous tomentum; disk of clypeus with black hair, but its lower margin with a long white fringe.
albobarbata Cockerell.
Abdomen not thus colored..... 16.
16. Abdomen coal-black, with short black hair; insect at least 18 millimeters long 17.
Abdomen not thus black-haired, or, if appearing dark, insect much smaller 18.
17. Sides of front with white hair..... lachesis Smith.
Sides of front with black hair..... lachesis nigrolateralis Cockerell.
Sides of front with black hair, but insect much larger; fully 20 millimeters long; wings very dark..... cloths Smith.

- | | | |
|--|-------------------------------------|-----|
| 18. Tarsi red | tarsatula Cockerell. | |
| Tarsi dark, except for the hair | | 19. |
| 19. Anterior tarsi modified, with a yellow boat-shaped process. | navicularis Cockerell. | |
| Anterior tarsi without such a process | | 20. |
| 20. Anterior tarsi broadened, ferruginous | structilis Cockerell. | |
| Anterior tarsi black | | 21. |
| 21. Anterior and middle tarsi with long white hair behind | laticeps Smith. | |
| Anterior tarsi simple, ordinary | | 22. |
| 22. Sixth abdominal segment above without light tomentum, or (<i>candentula</i>)
only with red hair at sides | | 23. |
| Sixth abdominal segment above with light tomentum | | 25. |
| 23. Fifth abdominal segment covered with red tomentum. | candentula Cockerell. | |
| Fifth abdominal segment without red tomentum | | 24. |
| 24. Hair of scutellum black | merrilli Cockerell. | |
| Hair of scutellum ocherous | mogregori Cockerell. | |
| 25. Hair of head and thorax above largely black, that on scutellum long. | philippinensis Friese. | |
| Like the last, but the dense tomentum of abdominal bands and sixth
segment golden fulvous; mandibles with three large teeth and a small
tooth between first and second | philippinensis vizcayana Cockerell. | |
| Hair on head and thorax above largely black or dark fuscous, but
relatively short on scutellum; mesothorax glistening .. | valdezi Cockerell. | |
| Hair on head and thorax above ocherous (rarely a little fuscous);
mesothorax dull | subrixator Cockerell. | |

Megachile clotho Smith.

Megachile clotho SMITH; COCKERELL, Ann. & Mag. Nat. Hist. (1915), VIII. 15. 266.

MINDANAO, Dapitan (from *Baker*). Brown⁴ listed the species from the Philippines, without particulars.

Megachile tuberculata Smith.

Megachile tuberculata SMITH, Journ. Linn. Soc. London (1858), 2, 46.

Megachile longipalpis RADOSZKOWSKI, Wiadom. z. nauk. przyrodz.
Warszaw (1882), 2. 79.

Female, 26 millimeters long. According to Friese *longipalpis* is the same as *tuberculata*, and there seems to be nothing in the descriptions to indicate the contrary. *Megachile tuberculata* was originally described from Sarawak; *M. longipalpis* is recorded from the Philippines.

Megachile atrata Smith.

Megachile atrata SMITH, Cat. Hym. Brit. Mus. (1853), 1, 182;
ASHMEAD, Proc. U. S. Nat. Mus. (1904), 28, 149.

⁴ *This Journal* (1906), 1, 606.

Originally described from the Philippine Islands, the particular island not mentioned. My specimen, from F. Smith's collection, was obtained in Amboina.

***Megachile lachesis* Smith.**

Megachile lachesis SMITH, Journ. Linn. Soc. London (1861), 5, Suppl., 188; BROWN, Phil. Journ. Sci. (1906), 1, 686.

Described from Batchian and Amboina. Possibly the typical form does not occur in the Philippines. My specimen is from Bismarck Archipelago.

***Megachile lachesis nigrolateralis* Cockerell.**

Megachile lachesis nigrolateralis COCKERELL, Ann. & Mag. Nat. Hist. (1914), VIII, 13, 279.

LUZON, Laguna, Los Baños (*Baker*). Only the male is known.

***Megachile davaonensis* sp. nov.**

Female.—Length, about 15 millimeters; entirely black, with short black hair, but the tubercles posteriorly fringed with white tomentum; face broad, eyes converging slightly above; mandibles with a broad cutting edge, on which are only two salient teeth; clypeus short and broad, rugose all over, but glistening, the lower margin with two widely separated small teeth; front densely rugose-punctate; vertex with very large punctures on a shining ground; cheeks sharply carinate posteriorly; mesothorax and scutellum very coarsely punctured, the punctures more or less confluent in a transverse direction; tegulae black; wings reddish translucent, stigma and nervures ferruginous; hind basitarsi not enlarged; abdomen with short black tomentum and the scopa black.

MINDANAO, Davao (from *Baker*). Looks like an undersized *M. atrata* var. *fulvipennis* Smith; but the clypeus and the mandibles are very different, and the wings are duskier.

***Megachile bakeri* sp. nov.**

Female.—Length, about 16 millimeters; black, with the ventral scopa light fulvous, black on last two segments; mandibles with a very long cutting edge, two obtuse apical teeth, and the rest of the margin with a strong double curve, but not dentate; disk of clypeus and of supraclypeal area (which is flattened) polished and sparsely punctured; front and vertex with dark chocolate-colored hair, sides of face and lower part of cheeks with white hair; vertex with minute dense punctures in middle and scattered punctures at sides; eyes olive green; mesothorax dullish, with dense round punctures, not confluent;

thorax above with thin, short black hair, sides of metathorax with long and abundant cream-colored hair, tubercles fringed with light tomentum, prothorax and lower part of pleura with creamy white hair; tegulæ black; wings dusky reddish, apical margin darker; nervures and stigma piceous; legs stout, with pale hair, red on inner side of tarsi; hind basitarsi greatly broadened, longer than the remaining joints together; spurs ferruginous; abdomen finely punctured, with distinct green and purplish tints; no hair bands, but segments 1 to 4 with white fringes at sides; fifth segment dull and granular, with thin, short black hair.

LUZON, Laguna, Mount Maquiling (*Baker*). A very fine species, the smooth shining area on the face resembling the Bornean *M. shelfordi* Cameron, but that has a black scopa.

***Megachile ocellifera* sp. nov.**

Female.—Length, about 10 millimeters; black, with the greater part of middle and hind coxæ and femora, large patch on hind tibiæ posteriorly, and base of abdominal venter all bright ferruginous; ventral scopa pale yellowish, black on last segment; clypeus densely and coarsely punctured; sides of face with conspicuous white hair; head and thorax above with short black hair; ocelli extremely large, especially the lateral ones; mesothorax strongly and quite densely punctured; pleura with thin pale hair; tegulæ black; wings dusky translucent; hind basitarsi broadened; abdomen with five linear white hair bands; disks of the segments conspicuously, transversely sulcate.

MINDANAO, Davao (from *Baker*). In all respects very close indeed to *M. tarsatula*, but easily separated by the immense ocelli, which suggest that it is a nocturnal species.

***Megachile tarsatula* Cockerell.**

Megachile tarsatula COCKERELL, Ann. & Mag. Nat. Hist. (1915), VIII, 15, 530; Entomologist (1916), 159.

NEGROS, Cuernos Mountains (type locality). MINDANAO, Dapitan and Davao (from *Baker*). PALAWAN, Puerto Princesa (from *Baker*).

***Megachile metallescens* sp. nov.**

Female.—Length, about 12.5 millimeters; black, including the mandibles, legs, and antennæ; but the tegulæ are bright ferruginous, while the shining dorsal surface of the abdomen has strong blue and coppery tints; mandibles with four subequal teeth; eyes reddish; cheeks angulate behind; clypeus rough and

coarsely punctured, but with a polished area on its upper part; sides of face conspicuously tufted with fulvous hair; mesothorax and scutellum brilliantly polished, strongly but not very closely punctured, scutellum with a shining impunctate area anteriorly; hair of mesothorax pale, short, and scanty; disk of scutellum with fuscous hair, but postscutellum, sides of metathorax, and tubercles with long pale fulvous hair; pleura with thin brownish white hair; base of metathorax with a median pit; wings dusky, stigma and nervures dusky red; legs with thin pale hair, reddened on inner side of tarsi; hind basitarsus only moderately broad; abdomen with pale fulvous hair on first segment; segments 2 to 4 with shaggy white hair bands, weak or interrupted in the middle; ventral scopa white, black on last two segments.

LUZON, Laguna, Mount Maquiling (*Baker 7454*). In Friese's table of Oriental species this runs near *M. umbripennis*, but it is quite distinct.

***Megachile rufofulva* sp. nov.**

Female.—Length, nearly 12 millimeters, rather slender; black, including mandibles, antennæ, and legs; mandibles tridentate, the third tooth very broad; clypeus densely rugose, with a T-shaped polished shining area, the transverse part of which is partly supraclypeal; vertex closely punctured; cheeks with white hair; clypeus with black hair, but on each side of it there is white; front with mixed black and white, vertex with black hair; mesothorax and scutellum shining but closely punctured, with short black hair on disk, but grayish white on side of mesothorax and a line of white in scutello-mesothoracic suture; pleura and tubercles with white hair, but that on postscutellum and metathorax creamy or suffused with fulvous; tegulæ small, dark brown; wings dusky translucent; hind basitarsi very broad, with red hair on inner side; anteriorly the hind tibiæ and tarsi have stiff glittering white hair, forming a fringe; abdomen finely roughened, the hind margins of the segments with fulvous hair bands, on fourth and fifth segments the fulvous hair covering over half the surface, sixth with fine, appressed, pale fulvous hair; ventral scopa bright ferruginous, cream-colored at extreme base.

MINDANAO, Zamboanga (from *Baker*). Allied to the Bornean *M. tarea* Cameron, but distinct; our species has only a very small red projection at apex of anterior tibiæ, and the legs are not covered with fulvous hair.

***Megachile chlorura* sp. nov.**

Female.—Length, about 13 millimeters; black, including

mandibles, legs, and antennæ, but abdomen above with strong green and steel-blue tints; mandibles tridentate, the third tooth very broad and low; eyes brown; cheeks covered with white hair; face and front with white hair; long, slightly creamy hairs converging from each side to middle of clypeus; a polished shining space on upper part of clypeus and supraclypeal area; thorax with white hair, abundant at sides and behind, but very thin above; a little, short fuscous hair on mesothorax; mesothorax polished, sparsely punctured; scutellum impunctate anteriorly, densely punctured posteriorly, tegulæ black, wings hyaline, apical margin broadly dusky; nervures piceous; legs with pale hair, orange-fulvous on inner side of tarsi, hind basitarsi broad; abdomen with a dense patch of white hair on each side of first segment and weak white hair bands on second and fifth; ventral scopa bright ferruginous.

LUZON, Laguna, Mount Maquiling (*Baker* 7455, 7456). Related to the Australian *M. pictiventris* Smith, but the latter has a quantity of black hair on head and thorax.

***Megachile hera* Bingham.**

Megachile hera BINGHAM, Faun. Brit. India, Hymenoptera (1897), 1, 489; BROWN, Phil. Journ. Sci. (1906), 1, 686.

LUZON, Laguna, Mount Maquiling (from *Baker*). This species was described from Tenasserim; I have not seen types or topotypes, but the specimens before me agree with Bingham's description. The species is certainly very close to *M. subrixator*.

***Megachile philippinensis* Friese.**

Megachile philippinensis FRIESE; COCKERELL, Entomologist (1916), 159.

LUZON, Laguna, Los Baños (type locality) and Mount Maquiling: Nueva Vizcaya, Imugan: Benguet, Baguio. MINDANAO, Dapitan. PALAWAN, Puerto Princesa. All from *Baker*. Allied to *M. tranquilla* Cockerell, from Formosa.

***Megachile philippinensis* var. *vizcayana* var. nov.**

Male.—Length, about 8 millimeters; the three broad abdominal bands, and hair on upper side of sixth segment, golden fulvous; mandibles with four teeth, the fourth largest, the second very small. It is larger than typical males.

LUZON, Nueva Vizcaya, Imugan (from *Baker*).

***Megachile valdezi* (Cockerell).**

Megachile abluta valdezi COCKERELL, Entomologist (1916), 159.

LUZON, Laguna, Mount Maquiling (type locality). MINDANAO, Zamboanga and Davao (from *Baker*). In the original

description it was stated that the ventral scopa was white, black on last segment; however, with a compound microscope it can be seen that the hair is orange subapically. The Davao females have the scopa (except basally and apically) very bright orange-fulvous and approach *M. subrixator*. *Megachile valdezi* and *subrixator* are very closely related and may be only races of one species. I formerly referred both to the Formosan *M. abluta* Cockerell as races.

***Megachile subrixator* (Cockerell).**

Megachile abluta subrixator COCKERELL, Ann. & Mag. Nat. Hist. (1915), VIII, 15, 535.

MINDANAO, Iligan (type locality), Dapitan, Davao, Zamboanga. NEGROS, Cuernos Mountains. LUZON, Laguna, Mount Maquiling and Los Baños: Bataan, Mount Limay. All from Baker.

***Megachile robbii* Ashmead.**

Megachile robbii ASHMEAD, Proc. U. S. Nat. Mus. (1904), 28, 128; COCKERELL, Proc. U. S. Nat. Mus. (1909), 36, 415.

LUZON, Manila. I examined Ashmead's type in the United States National Museum.

***Megachile albobarbata* Cockerell.**

Megachile albobarbata COCKERELL, Ann. & Mag. Nat. Hist. (1915), VIII, 16, 488.

MINDANAO, Dapitan (from Baker). Allied to the Australian *M. mystacea* (Fabricius).

***Megachile navicularis* sp. nov.**

Male.—Length, 7.5 to 9.5 millimeters, rather slender; black, with pale ocherous pubescence, pure white on lower part of cheeks and pleura and on femora (dense on underside of anterior pair); anterior coxæ with short spines; anterior tarsi fringed with long white hair behind, the basitarsus black with a long yellow boat-shaped process, extending its whole length and a short distance beyond its end, small joints of the tarsus ferruginous; face covered with pale golden or whitish hair; antennæ black, simple; vertex very densely and minutely punctured; mesothorax and scutellum dull and granular; no distinct hair band in scutello-mesothoracic suture; tegulæ reddish, fuscous basally; wings dusky; abdomen with apical and subbasal pale hair bands, but no subbasal one on second segment; fifth segment with basal two-thirds covered with whitish tomentum; sixth densely covered dorsally with pale yellow tomentum, the transverse keel denticulate and emarginate in middle.

LUZON, Laguna, Mount Maquiling (from *Baker*; 7452, type; 7451). This species looks like *M. subrixator*, but it is easily distinguished by the anterior legs.

***Megachile structilis* sp. nov.**

Male.—Length, about 12 millimeters; parallel-sided; black, with the anterior tarsi broad and thick, clear ferruginous, having posteriorly a short fringe of white hair; hair above pale fulvous, fuscous on vertex and disk of mesothorax; mandibles tridentate; cheeks beneath with pure white hair, upper margin of clypeus straight, shining; antennæ black, very long and slender; eyes brown; mesothorax closely and very finely punctured, but shining between the punctures; hair of thorax above long and abundant, especially posteriorly; tegulæ small, very dark brown; wings dusky translucent; anterior coxæ with large stout spines; middle and hind tarsi fringed with long white hair in the manner of *M. laticeps*; joints of middle and hind tarsi thickened; abdominal bands fulvous, apical and basal, the fifth segment almost entirely covered with pale fulvous tomentum, with black hairs interspersed; sixth similarly covered, with a median longitudinal ridge above, the apical transverse keel very broadly rounded, feebly crenulate, not distinctly notched.

LUZON, Laguna, Los Baños (*Baker* 6302). Resembles *M. laticeps*, but easily known by the structure of the anterior legs. Male *laticeps* has the anterior coxæ unarmed.

***Megachile laticeps* Smith.**

Megachile laticeps SMITH, Cat. Hym. Brit. Mus. (1853), 1, 183;
COCKERELL, Ann. & Mag. Nat. Hist. (1914), VIII, 13, 430.

LUZON, Laguna, Los Baños (*Baker* 1790); Mount Maquiling (*Baker* 7453). Only males have been received. Smith described the species from a male from the Philippine Islands. According to Meade-Waldo, the insect described by Cameron (1905) from Borneo as *M. varidens* is identical with *M. laticeps*.

***Megachile candentula* Cockerell.**

Megachile candentula COCKERELL, Ann. & Mag. Nat. Hist. (1915), VIII, 15, 532.

MINDANAO, Dapitan (*Baker* 3140, 3144).

***Megachile merrilli* sp. nov.**

Male.—Length, nearly 9 millimeters; parallel-sided; black, the small joints of anterior tarsi distinctly swollen and brownish; hair of vertex, scutellum, and posterior two-fifths of mesothorax long and black; of face yellow, of cheeks and most

of thorax white, on anterior part of mesothorax thin and white, the tuft below tegulæ slightly yellowish; antennæ long and slender, black; vertex densely punctured; mesothorax and scutellum very densely and minutely punctured, but glistening; tegulæ black; wings dusky; abdomen rather short, shining, with feeble white hair bands, the basal ones very thin, the apical only at sides; keel of sixth segment feebly developed, broadly rounded, obtusely emarginate, with a depression above the emargination. Anterior coxæ without spines.

LUZON, Laguna, Mount Maquiling (*Baker*). This and the next are named after naturalists whose contributions to the knowledge of the Philippine biota can never be forgotten.

Megachile mcgregori sp. nov.

Male.—Length, about 10.5 millimeters; similar to *M. merrilli*, but larger and also differing thus: Hair of thorax above warm ochereous, without black; tegulæ ferruginous; wings with a distinct reddish tint; punctures of mesothorax quite distinct under a lens; anterior tarsi entirely black; keel of sixth abdominal segment broadly emarginate. The anterior coxæ are without spines.

LUZON, Laguna, Mount Maquiling (*Baker* 7450).

Genus **ANDROGYNELLA** Cockerell

Female wholly without ventral scopa, but with sting well developed; antennæ of female 13-jointed and anterior coxæ spined, as in male.

Androgynella subrixator sp. vel forma nov.

Female.—Nearly 9 millimeters long, with the general character of *Megachile subrixator* from the same locality, but abdomen smooth beneath, without any ventral scopa, though the form of the abdomen is that of a female and the sting is present; anterior parts, including head, as in male, face covered with yellow hair, antennæ long and 13-jointed, and anterior coxæ with sharp spines. A second specimen, however, has shorter antennæ, which are only 12-jointed.

MINDANAO, Davao (from *Baker*). I should regard these as simple gynandromorphs of *Megachile subrixator*, which they may be, but for the fact that a similar type (*Androgynella deterasa* Ckll.) is established as a genuine species in Australia. I have discussed this subject⁵ and have shown that the characters in the Australian form are constant in a considerable series. In

⁵ *Ann. & Mag. Nat. Hist.* (1911), VIII, 7, 314.

our bee the antennal character is not constant and there is more reason for considering the form an ordinary gynandromorph. Therefore I give it the same specific name as that of the species from which it appears without doubt to have been derived. In discussing *A. detera*, of which both sexes are known, I wrote as follows:

Mr. R. E. Turner examined 14 female specimens in his collection, and all had 18-jointed antennæ and wholly lacked a ventral scopa. [It should be added that the anterior coxæ are spined.] It is, therefore, certain that this is a normal condition, and must represent an early stage in the evolution of a parasitic species, like those of *Cœlixys* and *Stelis*. From the standpoint of genetics, it is an extraordinary case, since the female seems to have dropped her secondary sexual characters and thereby assumed those of the male, which were present in her genetic constitution. It is noteworthy that the sting, a modified primary character, is retained. It appears that in *Megachile* the female is heterozygous for the secondary sexual characters, with the female characters dominant.

Thus a new generic type has been produced by the simple dropping out of one set of characters. It may be objected that the insect is still essentially a *Megachile*, and this is indeed true as regards its major characters, but according to any logical system of classification it must go in a distinct generic group, as otherwise our current definition of *Megachile*, applicable to hundreds of species all over the world, breaks down.

Presumably the male of *Androgynella subrixator* cannot be distinguished from *Megachile subrixator*.

Genus **HERIADES** Spinola

Heriades sauteri philippinensis Friese subsp. nov.

Female.—Like *H. sauteri* Ckll., from Formosa, but more finely punctured on mesothorax and first abdominal segment. Very small bees, a little over 6 millimeters long, with white ventral scopa.

LUZON, Laguna, Los Baños (*Baker 550*), Mount Banahao (*Baker*). Doctor Friese had named this in manuscript as a distinct species, *H. philippinensis*; I publish the name with his permission. It is so close to the Formosan *H. sauteri* that I was at first disposed to consider it identical. Friese very probably bestowed his manuscript name before *H. sauteri* was published.

APPENDIX TO XYLOCOPIDÆ AND CERATINIDÆ

Mesotrichia subvolatilis sp. nov.

Male.—Length, about 21 millimeters; anterior wing, 19; entirely covered with rich orange-yellow (not at all green) hair; apex of abdomen with ferruginous hair, not at all mixed with black; clypeus roughened, with broad median longitudinal and

apical transverse yellowish testaceous bands; labrum with a small basal yellow spot; mandibles with a large light basal spot; scape testaceous beneath; flagellum ferruginous beneath, black above; wings dusky, darker apically, with purple tints; first transverse-cubital nervure rather weak below, but complete; hind tibiae with a band of bright copper-colored hair; hair of hind tarsi reddened.

MINDANAO, Davao (from Baker). *Mesotrichia volatilis* (*Xylocopa volatilis* Smith) was based on a male collected by Wallace at Menado, Celebes. Smith's description agrees well enough with the insect now described to suggest identity, but he fails to give measurements. Maidl records a specimen from Samanga, southern Celebes, and informs us that it is about 30 millimeters long, the anterior wings 24 millimeters, while the first transverse-cubital nervure is obsolete basally. This is manifestly not our species, and since Maidl's insect, coming from Celebes (though indeed from a very different part of the island) is presumably correctly named, a new name is given to the Philippine form. *Mesotrichia euchlora* (Pérez) was also collected at Davao.

Allodape picitarsis Cameron.

A male from Baguio is evidently distinct from *A. marginata*, having the wings brownish, the middle and hind tarsi red, the anterior tarsi pale reddish with the base black. This may be separable from true *picitarsis*, of the Laccadive Islands, but more material is needed.

Allodape mindanaonis Cockerell.

A new locality is Davao, Mindanao (from Baker).

Ceratina philippinensis Ashmead.

Additional localities: MINDANAO, Davao. PALAWAN, Puerto Princesa. Both from Baker.

Ceratina tropica Crawford.

Additional localities: LUZON, Laguna, Mount Maquiling. MINDANAO, Davao. Both from Baker.

Ceratina flavolateralis Cockerell.

Male from Mount Maquiling; both sexes from Davao, Mindanao (Baker 7428, 7429). The female, not before known, is marked like the male. In the table this species runs in at the end, *i*³. Pleura all yellow.

Ceratina dentipes Friese.

Additional localities: MINDANAO, Cagayan and Davao (from Baker).

Ceratina bicuneata sp. nov.

Female.—Length, 7 to 8 millimeters; black, with chrome yellow markings as follows: Band across lower part of clypeus (widest in middle and obtusely angular above), transverse supraclypeal band (angular above), two small spots on middle of front, cuneiform lateral marks (broad below, ending above at about level of antennæ), occipital band, ending in a large patch on each side, band on prothorax, tubercles, spot behind tubercles, transverse patch occupying greater part of scutellum (subtrilobed anteriorly and narrowly incised in middle), knees, anterior femora beneath, anterior and middle tibiæ on outer side, and hind tibiæ at base; tibiæ (where not yellow) and tarsi reddish; abdomen with five yellow bands, that on first segment poorly developed, consisting of a median patch and small, almost disconnected, sublateral yellow marks; band on second segment slender, with a large patch at each side, on third narrowed in middle and sublaterally, on fourth and fifth (where the surface is rough) broad in middle; sixth segment with an obscure median yellow spot; scape obscure reddish basally; tegulæ ferruginous; wings dusky translucent; stigma piceous; face and front with very large punctures; upper part of cheeks polished and impunctate; mesothorax with the disk polished and impunctate, the narrow margins and the broad lateral anterior corners with strong punctures, but not roughened; base of mesothorax finely roughened, appearing under the microscope to be covered with longitudinal ridges, except sublaterally posteriorly, where it is very minutely cancellate; abdomen broad.

LUZON, Benguet, Baguio (from Baker). Related to *C. lepida*, *simillima*, and *rugifrons*, but distinguished by the face markings and structure of base of metathorax. In the table of Philippine species it runs to *C. philippinensis*, from which it is easily known by the polished mesothorax, with strong well-separated punctures in the anterior lateral region.

Subgenus *Chloroceratina* novum*Ceratina cyanura* sp. nov.

Female.—Length, about 7 millimeters; the slightly dusky wings long and ample; abdomen broad apically, but narrowed to base, making it broadly clavate; head shining dark blue, with pale yellow marks as follows: Large quadrate mark (with

triangular projection below) on clypeus, small transverse mark at each side of clypeus, semilunar lateral marks with a finger-like projection below; labrum pallid, except lower margin; mandibles black, with a reddish band; lower part of clypeus black; front and cheeks polished and impunctate; flagellum mainly pale testaceous beneath, but last two joints dark; mesothorax green, smooth, and polished, feebly punctate anteriorly; rest of thorax black, except for cream-colored marks as follows: Large part of prothorax (including tubercles), broad vertical band (with triangular projection posteriorly) behind tubercles, oblique band behind posterior margin of mesopleura, large mark on scutellum shaped like a bird in flight (but upside down); area of metathorax plicate at base; tegulae rufous; second submarginal cell a nearly equilateral triangle; legs hairy, mainly piceous, but all the femora and anterior and middle tibiae pale testaceous beneath; abdomen bright blue, with the bases of the first three segments broadly testaceous; apical segments with black hair.

LUZON, Nueva Vizcaya, Imugan (*Baker 8062*). An entirely unique species, at once known by its remarkable colors and markings. In the previously known Philippine fauna it is closest to *C. benguetensis*, which has a very perceptible green tint on the front, vertex, and mesothorax. *Ceratina benguetensis* also has a bicolored flagellum, and the abdomen is somewhat clavate. The two species form a new subgenus *Chloroceratina* (type *cyanura*), distinguished from *Ceratinidia* by the coloration and the shape of the abdomen.

DESCRIPTIONS AND RECORDS OF PHILIPPINE COCCIDÆ

By ELIZABETH ROBINSON

THREE TEXT FIGURES

DACTYLOPIINÆ

Phenacoccus spinosus sp. nov. Fig. 1a, 1b.

Female thinly covered with white cottony secretion, about 3 millimeters long, 2.5 broad, slender fragile filaments about 3 millimeters long. Mounted female ovate, 2.5 millimeters long, 1.30 broad, light brown. Antennæ 9-jointed, measurements in microns: (1) 50, (2) 75, (3) 75-77, (4) 55-60, (5) 62.5, (6) 50, (7) 47.5-50, (8) 50-52.5, (9) 72.5-77 (fig. 1a).

Legs slender, length of joints in microns are as follows:

Leg.	Coxa.	Trochanter plus femur.	Tibia.	Tarsus.	Claw.
	Microns.	Microns.	Microns.	Microns.	Microns.
Middle	100	330	150	82.5	20-22.5
Hind	112.5	397	337.5	102.5	27.5

Claw with a single denticle; digitules slender, no longer than claw. Six rounded caudal lobes bearing hairs about 200 microns long. Six spiny hairs of anal ring, 125 to 138 microns long. Around the body, and equidistant between ventral and dorsal lines, a series of circular areas composed of pores and truncate spines.

Larva ovate, yellow, 1.50 millimeters long, 0.75 broad. Fewer patches of pores and truncate spines. Antennæ 6- or 7-jointed. Entire length of 6-jointed antenna, 235.5 microns; of 7-jointed antenna, 337.5 microns. Length of middle leg in microns: Coxa, 50; trochanter plus femur, 155 to 160.5; tibia, 100 to 110; tarsus, 80; claw, 18 to 22.5 (fig. 1b).

LUZON, Laguna, Paete (*R. C. McGregor*), March, 1917, on *Ficus nota* (Blanco) Merr.

Many of the characters resemble those of *Phenacoccus azaleae* Kuwana and *Pseudococcus nitidus* Brain. The large legs and antennæ of this species differentiate it from both.

***Pseudococcus virgatus* (Cockerell).**

LUZON, Manila, Malate (*McGregor*), April, 1917, on *Hibiscus rosa-sinensis* Linn.: Rizal Province, Fort William McKinley (*McGregor*), April, 1917, on *Bridelia stipularis* (Linn.) Blume.

DIASPINÆ

***Hemichionaspis aspidistræ* (Signoret).**

LUZON, Laguna, Paete (*McGregor*), March, 1917, on the mature fruit of *Areca catechu* Linn.

***Aspidiotus cydoniæ* Comstock.**

LUZON, Manila (*McGregor*), April, 1917, on *Samanea saman* Merr.

***Pseudaonidia manilensis* sp. nov. Fig. 2.**

Female scale circular to subcircular, convex, 1.50 to 1.75 millimeters in diameter, dark brown; exuviae lateral to subcentral, yellowish brown.

Adult female oval; caudal margin with median lobes heavy, notched on each side, second and third pairs of lobes

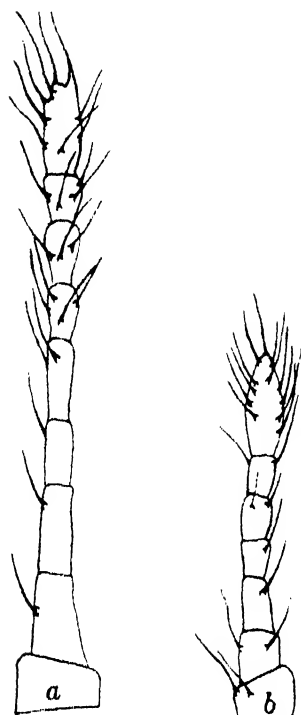


FIG. 1. *Phenacoccus spinosus* sp. nov., $\times 176$; a, antenna of adult female; b, antenna of larva.

narrow, transparent, variable in size and shape; fourth lobes represented by small rounded projections followed by a series of rounded projections and spines; bidentate or tridentate plates between the lobes (fig. 2). Circumgenital glands: Anterior laterals of 23 to 25 orifices, posterior laterals 8 to 12. Many tubular spinnerets. On dorsal surface an extensive reticulated patch, oval in outline, composed of irregular spaces.

In some specimens the lateral lobes resemble those of *Pseudaonidia curculiginis* Green, but that species lacks the tessellated area. The form of the median lobes is different in *Pseudaonidia trilobitiformis* (Green).

LUZON, Manila (*McGregor*), April, 1917, on *Samanea saman* Merr.



FIG. 2. *Pseudaonidia manilensis* sp. nov., caudal margin of female, enlarged.

Chrysomphalus rossi (Maskell).

LUZON, Laguna, Los Baños (C. F. Baker), June, 1916, on *Phalaenopsis* sp.

Greeniella javanensis (Green). Fig. 3.

Aonidia javanensis GREEN, Ent. Mo. Mag. (1880), 16, 31.

LUZON, Laguna, Mount Maquiling (Baker, 7011), March, 1914, on *Eugenia* sp.

This determination is based on the characters of the scale and structures of the adult. The species as represented by this material appears to have the characters of the genus *Greeniella*, including the waxy larval horns on female scale and prominent, irregular, variable processes of caudal area (fig. 3) similar to those of the type, *Greeniella cornigera* (Green).



FIG. 3. *Greeniella javanensis* (Green), caudal margin of female, enlarged.

Lepidosaphes gloverii (Packard).

LUZON, Laguna, Paete (McGregor), March, 1917, on mature fruits of *Areca catechu* Linn.

Cryptoparlatoria uberifera Lindinger.

Cryptoparlatoria uberifera LINDINGER, Zeits. f. Wiss. Insektenbiol. (1911), 7, 126.

Philippine Islands. On *Artocarpus* and *Mallotus philippinensis*. I have not seen this species.

ERRATA IN COCCIDÆ OF THE PHILIPPINE ISLANDS IN THIS JOURNAL, SECTION D (1917), 12, NO. 1

Page 4: To line 11 add (From the original description.).

Page 8: Line 6 from the bottom should read Type, *Pulvinaria pyriformis* Cockerell.

Page 9: In line 18 from the bottom for to read and.

Page 15: In the last line for (Plate II, fig. 21) read (Plate I, fig. 11).

Page 17: In line 11 for (Plate IV, fig. 9) read (Plate V, figs. 9 and 10).

Page 20: In line 22 add pellucida.

Page 20: In line 9 from the bottom for V read III.

Page 26: In line 15 for exuviæ read exuvia.

Page 29: In line 13 for Leonard read Leonardi.

Page 33: In line 14 for circuliginis read curculiginis.

Page 34: In lines 8, 9, and 10 for "circuliginis" read "curculiginis."

Page 37: In line 5 for (Plate V, fig. 4) read (Plate VI, fig. 3).

Page 43: In line 15 omit the comma after "base."

Page 47: In the first line for circuliginis read curculiginis.

ILLUSTRATIONS

TEXT FIGURES

- FIG. 1. *Phenacoccus spinosus* sp. nov., $\times 175$; *a*, antenna of adult female;
b, antenna of larva.
2. *Pseudaonidia manilensis* sp. nov., caudal margin of female, enlarged.
3. *Greeniella javanensis* (Green), caudal margin of female, enlarged.

NOTES ON JAPANESE LEPIDOPTERA AND THEIR LARVÆ:
PART V

By A. E. WILEMAN
(London, England)

TWO COLORED PLATES

HETEROCERA

LYMANTRIIDÆ

Genus **DASYCHIRA** Stephens

Dasychira STEPHENS, Ill. Brit. Ent. Haust. (1829), 2, 58.

Dasychira conjuncta Wileman.

Plate I, fig. 1, imago, ♂ (figured from the cotype); fig. 2, head.

Japanese name, *yoshino-dokuga*.¹

Dasychira conjuncta WILEMAN, Trans. Ent. Soc. London (1911), 270,
No. 271, ♂.

Dasychira conjuncta seems to be allied to *D. olga* Oberthür.² As a figure of this species was not given when the type was described, I take the present opportunity of figuring it from the drawing of a cotype in my possession. I also append my original description for convenience of reference.

♂. Forewings grey, clouded with darker on the basal and outer marginal areas; antemedial line blackish, inwardly oblique, elbowed at costa, post-medial line blackish, curved and recurved to just below vein 2 where it is connected with antemedial by a black bar, thence outwardly oblique to near the outer angle; marginal line blackish, crenulate, commencing at apex and projected inwards on vein 2; there are indications of a whitish, serrated, submarginal line; fringes grey variegated with paler at the ends of the nervules. Hindwings fuscous with blackish discal dot and marginal line; fringes pale grey flecked with darker between the nervules.

Underside whitish tinged with fuscous especially on the forewings; all the wings have a dusky discal spot and postmedial line.

Expanse 42 mm.

Male type from Yoshino, province Yamato, Honshu, June, 1900.

A series of eleven male specimens taken at Yoshino, province Yamato, in June, 1895, 1899, 1900, and 1901. The series shows but little variation

¹ This species has been named by me in Japanese after the locality⁴ where the type was taken, Yoshino, Yamato Province, Honshu.

² Oberthür, Etudes d. Entom. (1880), 5, 84, Pl. 2, fig. 1, ♀.

in colour and varies in expanse from 38 mm. to 42 mm. I have never taken a female.

Local distribution. Hondō (Honshū).

Habitat. Japan.

Collection number, 217.

Genus ORGYIA Ochsenheimer

Orgyia OCHISENHEIMER, Schmett. Fur. (1810), 3, 208.

Orgyia thyellina Butler.

Plate I, fig. 3, larva, dorsal view; fig. 4, food plant; fig. 5, larva, lateral view.

Japanese names: *Himeshiromon-dokuga*, *himetsuno-kemushiga*, *kotsuno-kemushi*, *kenaga-kemushi-chō*.

Orgyia thyellina BUTLER, Trans. Ent. Soc. London (1881), 10, ♂; LEECH, Proc. Zool. Soc. London (1888), 625, No. 218, Pl. 31, figs. 7, 7a, ♀ (normal and semiapterous forms); Trans. Ent. Soc. London (1899), 118, No. 410; MATSUMURA, Japanese Injurious Insects [Nihon Gaichūhen (Jap.)] (1899), 49, Pl. 21, fig. 1, imago, ♂; fig. 2, ♀; fig. 3, ova; fig. 4, larva; fig. 5, cocoon; SWINHOE, Trans. Ent. Soc. London (1903), 459; SASAKI, Insects Injurious to Japanese Trees [Nihon Jūmoku Gaichūhen (Jap.)], 3d ed. (1910), pt. 2, 30, Pl. 90, imago, ♂, ♀, and larva; Insects Injurious to Fruit Trees [Kwajū Gaichūhen (Jap.)], 5th ed. (1911), 66, 124, Pl. 33, larva, imago; MATSUMURA, Cat. Insect. Jap. (1905), 1, 40, No. 328; Thousand Insects of Japan [Nihon Senchū Dzukai (Jap.)] (1909), suppl. 1, 66, No. 112, Pl. 10, fig. 21, ♂; STRAND, Seitz's Macrolep. Faun. Pal. (1910), 2, 119, Pl. 22b, ♂; Pl. 19c, ♀ (normal and semiapterous forms).

Notolophus thyellinus KIRBY, Cat. Lep. (1892), 495.

The larva figured (Plate I, figs. 3 and 5) was taken in July (figured July 11), 1901, at Kobe, Settsu Province, Honshu, on wistaria, Japanese name *fuji* (*Kraunhia floribunda* Willd.). This larva died, and no imago was bred from it. I bred specimens from other larvæ compared with my original figure as follows: Two males at Kobe, May 31 and June 16, 1899; two females with normal wings, June 6, 1899, and July 15, 1901; one male, Hakodate, Hokkaido, September 20, 1902. My collector also captured semiapterous females on the cocoon, but I have never bred them from the larva.

The following description is taken from my original figure of the larva:

Larva.—Length, 37 millimeters. Yellow with grayish white lateral hairs; head gray; collar of segment 2 coral red; on each side of head is a long hornlike tuft of grayish black hairs, pointing forward; medial dorsal line grayish black, more or less attenuated on segments 2 and 3, broad on segments 4 to 8, and gradually tapering to segment 12; dorsal brushlike tussocks of

yellowish white hairs on segments 4 to 7; yellow dorsal tubercles on segments 9 to 11; red subdorsal tubercles on segments 2 to 3 and 9 to 12; a spiracular gray stripe, interrupted by red tubercles, emitting hairs; a subspiracular yellowish stripe; a lateral, compact, subspiracular, brushlike tuft of grayish black hairs on segment 6 and of thin fascicles of whitish gray hairs on each segment and anus; a long tuft of pinkish gray hairs pointing backward on segment 12. The larva was common on wistaria at Kobe in 1901. Matsumura says that it feeds upon the pear and other fruit trees. Matsumura³ records the life history of this species and gives figures of the male and the normal female imago, the ova, the larva, and the cocoon. He says that—

The species is double brooded and hibernates in the ova stage. The first brood appears in July and August, the second brood in September and October.

Sasaki⁴ also describes the life history and gives figures of the male and the normal female imagoes and of the larva. He says that the first brood of the larva appears in May and June and the second brood in August and September. The larva is full-grown by the middle of June and September, and the imago emerges at the end of June and October. He gives as food plants mulberry (*kuwa*); wistaria (*fui*); dwarf oak, *kunugi* (*Quercus serrata* Thunb.); *ō-kuro-umemodoki* (*Rhamnus japonicus* Maxim. var. *genuina* Maxim.).

The male flies in the day time like *gonostigma* Fab. The female does not cover its eggs with hairs from the anal tuft like *gonostigma*.

Imago.—Leech⁵ remarks:

A fine series, collection Pryer, including four female specimens with well-developed wings, and three examples of the same sex in which the wings are dwarfed, but with the markings reproduced in miniature.

Although very different in coloration, the markings of the female are exactly of the same character as those of the male. In reference to the females with ill-developed wings it should be said that these organs are very similar in appearance to the wings of a moth on its first emerging from the pupa and gives one the idea of arrested development. Instances of this nature are not unknown to the breeder of Lepidoptera, although the cause is not understood. There is nothing to show whether Pryer's specimens of this species were captured or bred; but as the semiapterous form is nearer to typical female *Orgyia* we may reasonably suppose that such forms as that figured are used with *O. thyellina*.

³ Matsumura, *Nihon Gaichūhen* (1899), 50, Pl. 21, figs. 1-5.

⁴ Sasaki, *Insects Injurious to Japanese Trees* [*Nihon Jūmoku Gaichūhen* (Jap.)], 3d ed. (1910), pt. 2, 30, Pl. 90.

⁵ Leech, *Proc. Zool. Soc. London* (1888), 625.

In this connection I may observe that I have three semi-apterous female forms of this species, taken, whilst seated on their cocoons, from which they had apparently just emerged, by my collector on October 28, 1898. This proves that the curious dimorphic form of the female is not the result of breeding, but that it is due to natural causes. It would be interesting to elucidate the reasons for this dimorphism of the same sex which, so far as I am aware, does not occur in any other species of the genus *Orgyia* in Japan.

Local distribution.—Honshu: Tokyo, Musashi Province (Fenton); Yokohama, Musashi Province (Pryer); Oiwake, Shinano Province (Pryer); Kobe, Settsu Province, May, June, July, October (Wileman); Asamayama, Shinano Province, August (Wileman); Hoshikawa, Musashi Province, June (Wileman). Kyushu: Shimo-shiiba, Hyuga Province, July (Wileman); Matsuo, Higo Province, July (Wileman). Shikoku: Higoshi-no-kawa, Ohoki, Iyo Province, July (Wileman); Iyamura, Awa Province, October (Wileman). Hokkaido (Yezo): Hakodate, Oshima Province, September (Wileman).

Time of appearance.—Larva, May to September; imago, May to October. Double-brooded.

Matsumura records the species from Honshu and Hokkaido and says that it is common at Sapporo, Ishikari Province, Hokkaido.

Genus CIFUNA Walker

Cifuna WALKER, Cat. Lep. Het. (1855), 5, 1172.

Cifuna locuples Walker.

Plate I, fig. 6, larva of *Cifuna confusa* Bremer.

Japanese names, *mame-dokuga* and *kumogata-kuchiba*.

Cifuna locuples WALKER, Cat. Lep. Het. (1855), 5, 1173; BUTLER, Ill. Typ. Lep. Het. (1878), 2, 18, Pl. 27, fig. 6, ♀; LEECH, Proc. Zool. Soc. London (1888), 632, No. 247; HAMPSON, Moths India (1892), 1, 446; Trans. Ent. Soc. London (1899), No. 421; STAUDINGER and REBEL, Cat. Lep. Pal. (1901), 1, 115, No. 897; MATSUMURA, Cat. Insect. Jap. (1905), 1, 40, No. 230; STRAND, Seitz's Macrolep. Faun. Pal. (1911), 2, 121, Pl. 19d, ♀.

Artaxia confusa BREMER, Lep. Ost.-Sib. (1864), 42, Pl. 4, fig. 5, ♂; STAUDINGER, Rom. Mém. Lép. (1892), 6, 303 (larva); STAUDINGER and REBEL, Cat. Lep. Pal. (1901), 115, No. 897a; SWINHÖE, Trans. Ent. Soc. London (1903), 479; MATSUMURA, Thousand Insects of Japan [Nihon Senchū Dzukai (Jap.)] (1909), suppl. 1, 61, No. 102, Pl. 10, fig. 10, ♂; NAGANO, Nawa's Insect World [Konchū Sekai (Jap.)] (1909), 13, 311, Pl. 15, figs. 1-13; STRAND, Seitz's Macrolep. Faun. Pal. (1911), 2, 121 (larva).

The larva figured (Plate I, fig. 6) was taken in May (figured May 17), 1901, at Yoshino, Yamato Province, Honshu, on *enoki* (*Celtis sinensis* Pers.). No imago was bred from this larva, but a male imago of form *confusa* Bremer, the larva of which was compared with my original figure, emerged on June 12, 1901. Two other female imagoes of the form *confusa* emerged from similar larvæ on June 18 and August 11, 1901, respectively. I also bred it at Hakodate, Hokkaido, on July 29, 1902.

Larva.—Strand^a says:

The larva [of *confusa* Brem.] is not unlike that of *fascelina* L. with long hairy brushes; those near the head yellow with darker hairs in the center; on low-growing plants, especially on vetches (Graeser).

Staudinger⁷ also gives a short but inadequate description of the larva. Matsumura says that it feeds upon *daizu* (*Glycine hispida* Maxim.); fuji, wistaria (*Kraunkia floribunda* Taub.); utsugi (*Deutzia scabra* Thunb.). The following description is taken from my original description of the larva:

Larva.—Length, 47 millimeters. Yellowish gray; dorsal medial black stripe ill defined from segments 2 to 8 (counting head as segment 1), broadly defined from segments 9 to 12, bordered on each side by a yellowish subdorsal line; two moderately long, blackish gray subdorsal tufts of hair pointing forward from large tubercles on segment 2; between the black medial and yellow subdorsal stripes there is a series of subdorsal tubercles on segments 2 to 4 and 7 to 12, which, with the exception of that on segment 2, emit short whitish gray spinelike hairs; laterally yellowish gray with a brownish yellow tubercle emitting small fascicles of gray hairs on each segment mid-laterally from segments 3 to 12; a spiracular line of similar tubercles and fascicles of thicker gray hairs, the fascicles on segments 5 and 6 being blacker and longer; two yellow medio-dorsal, cup-shaped tubercles on segments 9 and 10; four deep ruddy-brown brushlike tussocks of hair on segments 5 to 8; a short black brushlike tuft, pointing backward on segment 12; two longer black tufts on anal segment pointing posteriorly; anal segment yellow.

Nagano^a gives in Japanese a long description of the metamorphoses of *Cifuna locuples* Walker, accompanied by descriptions and figures of the ova, the larva, the cocoon, the pupa, and the imago. His description seems to agree with mine in so far as

^a Strand, Seitz's Macrolep. Faun. Pal. (1911), 2, 121.

⁷ Staudinger, Rom. Mém. Lép. (1892), 6, 303.

^a Nagano, Nawa's Insect World (Konshû Sekai) (1909), 15, 311, Pl. 15, figs. 1-13.

I am able to follow the Japanese text. He took larvæ on May 19 on *yoshi* (? *Phragmites communis* Trin. var. *longivalvis* Miq.) and on *utsugi* (? *Deutzia scabra* Thunb.). Those on *utsugi* pupated on May 26, and the imagoes emerged on June 7. The imago of one larva taken on *ibara* also emerged on June 15. From these imagoes he obtained a pair, which copulated, and from the ova laid by the female young larvæ emerged on June 18. These pupated on July 10, and imagoes emerged on July 22. From this he deduces that there are two broods in Gifu (Honshu) and that there may possibly be three broods, the ova probably hibernating. He says that the larva causes some injury to such cereals as barley. My experience with the larva is that it is more or less polyphagous.

Imago.—The type of *Cifuna locuples* Walker is, according to Butler, a female, not a male as described by Walker, and comes from Silhet, India. The type of *Artaxia confusa* Bremer is figured as a male, but Bremer does not give the sex in his description. It was discovered by Radde in the Bureja Mountains and Ussuri, both in eastern Siberia.

Local distribution.—Honshu: Oiwake, Shinano Province (*Pryer*); Yokohama, Musashi Province (*Pryer*); Yoshino, Yamato Province, June, August (*Wileman*); Nikko, Shimotsuke Province, July, August (*Wileman*); Kobe, Settsu Province, June, August (*Wileman*). Hokkaido: Hakodate, Oshima Province, June (*Leech, Andrews*). Matsumura records *confusa* Bremer from Hokkaido and Honshu.

Time of appearance.—Larva, May; imago, June to August.

General distribution.—*Cifuna locuples*: India; southern and central China (*Strand*). *Cifuna confusa*: Eastern Siberia, Amurland; Korea; Japan (*Strand*).

Genus LYMANTRIA Hübner

Lymantria HÜBNER, Verz. Bek. (1827), 160.

Lymantria mathura Moore.

Plate I, fig. 7, larva. Larva of *Lymantria aurora* Butler, ♀.

Japanese name, *kashiwa-maimai*.

Lymantria mathura MOORE, Proc. Zool. Soc. London (1865), 806; LEECH, Trans. Ent. Soc. London (1899), 128, No. 433; HAMPSON, Moths India (1892), 1, 464; STAUBINGER and REBEL, Cat. Lep. Pal. (1901), 1, 117, No. 930; SWINHÖE, Trans. Ent. Soc. London (1903), 489; MATSUMURA, Cat. Insect. Jap. (1905), 1, 43, No. 359; Thousand Insects of Japan [Nihon Senchū Dzukai (Jap.)] (1909), suppl. 1, 46, No. 75, Pl. 7, fig. 6, ♀; STRAND, Seitz's Macrolep. Faun. Pal., 2, 128, Pl. 20e, ♀.

Lymantria aurora BUTLER, Ann. & Mag. Nat. Hist. (1878), IV, 20, 408; Ill. Typ. Lep. Het. (1878), 2, 11, Pl. 24, fig. 5, ♀; PRYER, Trans. Asiat. Soc. Japan (1885), 12, 50, No. 170; STAUDINGER, Rom. Mém. Léop. (1892), 6, 312; MATSUMURA, Japanese Injurious Insects [Nihon Gaichūhen (Jap.)] (1899), 38, Pl. 46, figs. 1 and 2, imago, ♂ and ♀; fig. 3, cocoon; fig. 4, larva; fig. 5, pupa; STAUDINGER and REBEL, Cat. Lep. Pal. (1901), 1, 117, No. 930a; SWINHOE, Trans. Ent. Soc. London (1903), 488; STRAND, Seitz's Macrolep. Faun. Pal. (1911), 2, 128, Pl. 20e, ♂ and ♀.

Lymantria aurora var. *fusca* LEECH, Proc. Zool. Soc. London (1888), 629, No. 289, Pl. 81, fig. 9, ♂; STRAND, Seitz's Macrolep. Faun. Pal. (1911), 2, 128, Pl. 20e, ♂; SASAKI, Insects Injurious to Japanese Trees [Nihon Jumaku Gaichūhen (Jap.)], 3d ed. (1910), Pt. 2, 50, Pl. 98, imago, ♂ and ♀, larva.

The larva figured (Plate I, fig. 7) was taken at Kobe, Settsu Province, Honshu, in June (figured June 19), 1901, on evergreen oak, Japanese name, *kashi* (*Quercus acuta* Thunb.). It pupated on June 22, and a female of form *aurora* Butler emerged from the pupa on July 8. I bred the female form of *aurora* also from a similar larva on July 11, 1901. I have not bred typical *mathura*, so far, from the few larvæ reared. I have also taken the larva on *hazeno-ki* (*Rhus succedanea* L.), at Kosadake-machi, Higo Province, Kyushu. Matsumura gives as food plants the following trees: *Ko-nara* (*Quercus glandulifera* Bl.), *kashiwa* (*Quercus dentata* Thunb.), and *keyaki* (*Zelkova acuminata* Lind.). I found a larva on *kashiwa* at Yokohama on July 2.

The larva of *aurora* is an example of procryptic colors affording a general protective resemblance. This is defined by Poulton "as "concealment as a protection against enemies, effected by colors which harmonize with the total artistic effect of the immediate environment." The colors of the larva assimilate well with the bark of the trees on which it feeds, and it is often to be seen lying quiescent in some numbers on the trunks of such trees. Besides being protected from attack by its barklike resemblance, it is also protected by its urticating hairs, and on this account it must be handled with caution, or the results may be unpleasant.

The following description is taken from my original figure:

Larva.—Length, 80 millimeters. Grayish brown, bark-colored; head deep brown with lighter streaks; dorsum various shades of light yellowish brown and gray, ringed with lighter whitish gray at the segmental sutures; anal segment whitish gray; a longitudinal, medial, brownish dorsal line, interrupted, more or less, at the segmental sutures and there edged on

* Vide *This Journal*, Sec. D (1914), 9, Table I, facing p. 248.

both sides with darker color; transverse, orange dorsal patches on segments 3 and 4 (counting head as segment 1); two small mediodorsal tubercles on segments 10 and 11; one subdorsal series of tubercles on each side of dorsum emitting a few short hairs and running from segment 3 to anal segment; a lateral series of larger tubercles on each side, commencing on segment 2, which emit fascicles of ruddy gray hairs and end at the anal segment; ten long, compact pencils of hair, which are black, shaded with ruddy brown at the base; two (one on each side of the head), which belong to the lateral series of tubercles, point forward from segment 2 beyond the head; two, which belong to the lateral series of tubercles, are situated on each side of segment 12 and curve toward the anus; six are situated on the anal segment, three on each side, pointing posteriorly; the two central ones belong to the subdorsal series of tubercles, and the four lateral ones (two on each side) belong to the lateral series of tubercles.

The hairs urticate severely.

The type of *mathura*, male, is from northern India.

The types of *aurora*, male and female, are from Japan; female, Yokohama (*Jonas*).

Matsumura ¹⁰ records the life history of *Ocneria aurora* Butler and gives figures of the male and the female imago, the larva, the cocoon, and the pupa. He says that in Hokkaido it is single-brooded and hibernates in the ovum. The ova, which are covered with hairs from the anal tuft of the female, are deposited on twigs to the number of two hundred or more, and the larvæ emerge in the following spring. The larvæ pupate at the middle or end of July. The imago emerges in the middle of August.

Sasaki ¹¹ also records the life history of *Lymantria aurora* Butler and gives figures of the male and the female imagoes and the larva. He says that the larva appears in May and is full-grown by the end of June. The imago appears in July and then oviposits.

Local distribution.—Honshu: Tokyo, Musashi Province, July; Kawai and Dzushi, Musashi Province, July; Karuizawa, Shinano Province, August; Koyasan, Kishu Province, August (*Wileman*). Kyushu: June (*Wileman*). Shikoku: Ohoki, Iyo Province, July (*Wileman*).

¹⁰ Matsumura, Japanese Injurious Insects [Nihon Gaichūhen (Jap.)] (1899), 38.

¹¹ Sasaki, Insects Injurious to Japanese Trees [Nihon Jūmuku Gaichūhen (Jap.)], 3d ed. (1910), pt. 2, 50, Pl. 98.

I have taken this species, some specimens of which are apparently referable to *mathura* and others to form *aurora*, in the above-named localities. I also captured many specimens of form *aurora*, female, on the trunks of oak trees in the forests at Jozankei, near Sapporo, Hokkaido (Yezo), in August, 1896. The females were engaged in depositing their ova in the crevices of the bark with their long ovipositors. I also took male *aurora* in abundance at light in the same locality, also var. *fusca* Leech. The species occurs in Hokkaido (Yezo), Honshu, Shikoku, and Kyushu. Matsumura records the species from the same islands under *mathura*.

Leech also gives Loochoo Islands (Ryukyu) and Kurile Islands (Chishima-to) as localities for *mathura* and *aurora*. Swinhoe separates *mathura* and *aurora* and says of *Lymantria aurora* Butler:

In B. M. collection. 1 ♂, 1 ♀, Japan (types). 1 ♂, 1 ♀, Yesso (=Hokkaido). 4 ♂, Nagahama, (province Omi.), including type *fusca*. Sunk to *mathura* in the B. M. collection, but it is a distinct form, the male being uniformly blackish-brown. Butler's type example is an old, worn and faded specimen; whether his female type is really the female of this form is I think very doubtful.

Swinhoe says of *Lymantria mathura* Moore:

In B. M. collection. 1 ♂ N. India (type). 1 ♂, 1 ♀ Kangra. 1 ♀ Dehra Doon. 2 ♂, 1 ♀, Sikhim. 1 ♀, N. E. Himalayas. 3 ♂, 1 ♀, Loochoo Islands (Ryukyu). 1 ♀ Chefoo, East China. 2 ♀ Omeishan, West China. 2 ♂, 3 ♀ Japan.

Time of appearance.—Larva, May to July; imago, June to August.

General distribution.—*Lymantria mathura*: Kashmir, Japan, and widely distributed in India (*Strand*); Manchuria (*Matsumura*). *Lymantria aurora*: Eastern Siberia (*Amurland*), China, Korea, and Japan (*Strand*).

Genus **TOPOMESOIDES** Strand

Topomesoides STRAND, Seitz's Macrolep. Faun. Pal. (1910), 2, 133.

Topomesoides jonasii Butler.

Plate I, fig. 8, pupa, suspended; fig. 9, dorsal view; fig. 10, abdominal view.

Japanese names, *niwatoko-dokuga* and *usuiro-hoshi-ukon*.

Arca jonasii BUTLER, Ann. & Mag. Nat. Hist. (1877), IV, 20, 402; Ill. Typ. Lep. Het. (1878), 2, 10, Pl. 23, fig. 11, ♂; LEECH, Proc. Zool. Soc. London (1888), 647, No. 318; Trans. Ent. Soc. London (1899), 120, No. 414; MATSUMURA, Cat. Insect. Japan (1905), 42, No. 349; KAMIMURA, Nawa's Insect World [Konchū Sekai (Jap.)] (1906), 10, 495, larva, pupa, imago (black and white woodcut); (1907), 11,

548; MATSUMURA, Thousand Insects of Japan [Nihon Senchū Dzukai (Jap.)] (1909), suppl. 1, 139, Pl. 13, fig. 20, ♂.

Euproctis jonasi SWINHOE, Trans. Ent. Soc. London (1903), 410.

Topomesoides jonasi STRAND, Seitz's Macrolep. Faun. Pal. (1910), 2, 133, Pl. 19h (3), ♂.

Topomesoides gigantea STRAND, Seitz's Macrolep. Faun. Pal. (1910), 2, 133, Pl. 19h (4), ♂.

[*Topomesoides*.]—Most closely allied to *Topomesa* Walk., but vein 8 and 9 both terminate at the costal margin, 10 originating closer to the cell than 7, the discocellular of the hindwing is more oblique (the cell anteriorly considerably shorter than posteriorly) and veins 6 and 7 of the hindwing are separated at the base, 7 really originating from the anterior margin of the cell.—Type: T ("Aroa") *jonasi* Btlr.¹²

The type of *Aroa jonassii*, male, was from Yokohama. (*Jonas*.)

Strand erects a new genus for *jonassii*, which was left by Leech provisionally in *Aroa* with the following remarks:¹³

I have left this species in *Aroa* although it does not appear to be rightly placed therein, and a new genus will probably have to be made for its reception.

In June, 1901, I found a hairy larva, on an unknown tree, at Myoken-zan, near Kobe, Settsu Province, Honshu, and a female imago, which I identified at the South Kensington Museum as *Aroa jonassii*, emerged some time during the same month from the pupa resulting from this larva. When the imago emerged, I also identified it from Butler's figure.¹⁴ The moth is a common one and has always been well known to me as *Aroa jonassii*. Owing to press of work my artist was unable to figure the larva before it entered the pupal stage, but he figured the pupa on June 20, 1901, in three aspects (Plate I, figs. 8 and 9). I describe the pupa from my original figure as follows:

Pupa.—Dorsum green with a few yellow markings, three on each side; spiracles brownish; wing cases whitish; suspended by a silken pad attached to a leaf of the food plant. Kamimura,¹⁵ a Japanese lepidopterist of Shizuoka, Honshu, who bred imagos of *jonassii* on several occasions, gives figures of the larva, the pupa, and the imago. His figure of the larva resembles in form that of the larva from which my female *jonassii* emerged in June, 1901. However, I am not able to remember anything about the coloration of my larva except that it was dark and hairy. He describes his pupa as follows:

Pupa.—Color bright green; it hangs down attached by two or three

¹² Strand, Seitz's Macrolep. Faun. Pal. (1910), 2, 133.

¹³ Leech, Trans. Ent. Soc. London (1899), 120.

¹⁴ Butler, Ill. Typ. Lep. Het. (1878), 2, 10, Pl. 28, fig. 11, ♂.

¹⁵ Kamimura, Nawa's Insect World (Konchū Sekai) (1906), 10, 497, larva, pupa, imago, ♂.

silken threads; there are so very few of these silken threads that they can scarcely be called a cocoon.

Kamimura does not mention in the text the yellow streaks that appear on the dorsum of the pupa, but he figures them on his pupa. They are noticeable in my figure (Plate I, 9). His pupa is represented as suspended by the tail from a silken pad attached to a small twig. My pupa is represented in the same position, the silken pad being spun on the underside of a leaf of the food plant. This method of pupation seems rather peculiar for a lymantriid and is suggestive of that of a vanessid pupa, but I am informed by Mr. W. Schultze, formerly of the Philippine Bureau of Science, that *Leucoma marginalis* Walker,¹⁶ a Philippine species, has a somewhat similar mode of pupation. The larva of *marginalis* spins a silken pad and also attaches itself to the leaf by encircling its body with a few silken threads, which one might term a rudimentary cocoon. These threads break away, possibly after the pupa has formed, and the pupa is left suspended by the tail from the silken pad. The pupa of *marginalis* somewhat resembles that of *jonasii* in shape and coloration. It is figured by Semper,¹⁷ together with the larva, which is green and very hairy, quite different in color from that of *jonasii*.

Kamimura also expresses surprise at the method of pupation of *jonasii*, as will be perceived from my translation of his original Japanese text, which is given farther on. He states that the pupa hangs down attached by two or three silken threads and that there are so few of these threads that they can be scarcely called a cocoon.

In his figure of the pupa it is represented as suspended by the tail, like a vanessid pupa, from a silken pad attached to a twig, without any silken threads encircling the body, in such a way as to loop it up to the twig. The "two or three silken threads" that he mentions may either refer to the silken pad from which the pupa is suspended or to threads encircling the pupa, which have been severed. However, he does not throw any light upon this point, and it would be interesting to know whether the larva of *jonasii* undergoes its pupal transformation merely suspended from a silken pad. If so, it certainly has the habits of a vanessid larva. I am unable to say whether any silken threads encircled my pupa and attached it also to the leaf in addition to the silken pad. They may have been present and become

¹⁶ Walker, *Journ. Linn. Soc. London* (1862), 6, 128.

¹⁷ Semper, *Lep. Phil. Isl.* (1902), 6, 473, Pl. O, fig. 1, larva; fig. 2, pupa.

severed. Kamimura says, in writing of the larva of a moth that he names in Japanese *hoshi-usuiro-ūkon*, or the *kama-tsuka* caterpillar (identified by me from his figure of the male imago as the larva of *Topomesoides jonasii*), that he thought that this larva, which he reared in a breeding cage, together with another larva belonging to the family Lymantriidæ, also belonged to the same family. Much to his surprise this larva, instead of spinning a cocoon as an ordinary lymantriid should do, affixed itself by the tail to the top of the breeding cage and passed through the pupal transformation without spinning a cocoon. He, therefore, thought that some mistake had occurred. However, on rebreeding similar larvæ on several occasions in subsequent years imagoes of *Aroa jonasii* always emerged from them.

The larva is described by him as follows:

Larva fifth stage. Head black and shining; the whole of the body black; black dorsal tubercles on segments 3 and 7; body covered with light brown hairs, which are particularly long from segments 1 to 3 and from segment 10 to anal segment; the central segments of the body, 8 and 9, are chiefly yellow; segments 6 and 7 are not so yellow; segments 4 to the anal segment are marked with yellow spots on the spiracular line; ventrum of last segment is ashy-yellow.

The larva feeds on the *Kama-tsuka*,¹ if molested it wriggles about and falls down.

* * * the imago emerges at the beginning of May and larvæ in their third or fourth stages are also to be found during the same month. A larva in its fourth stage, taken on 8 May, became dormant on 14 May and changed into the fifth stage on 14 May; it pupated on 29 May and the imago emerged on 7 June.

The food plants of *jonasii* are: *Niwa-toko* (*Sambucus racemosa* L.), also called in Japanese *tazu-no-ki*, *komo-utsugi*, and *kobu-no-ki*. *Kamatsuka* is also called *ushi-koroshi* (*Pourthiaea villosa* Dcne.).

Local distribution.—Honshu: Oiwake, Shinano Province (*Pryer*); Yokohama, Musashi Province (*Jonas*); Hoshikawa, Musashi Province, July (*Wileman*); Yoshino, Yamato Province, June (*Wileman*); Nikko, Shimotsuke Province, August (*Wileman*); Myoken-zan, Settsu Province, May (*Wileman*); Hakone, Sagami Province, August (*Leech*). Kyushu: Satsuma Province, May (*Leech*); Nagasaki, Hizen Province, June (*Leech*); Kimbo-san, Higo Province, May (*Wileman*). Matsumura records the species from Honshu and Kyushu.

Time of appearance.—Larva and pupa, May and June; imago, May to August.

General distribution.—Japan and Korea (*Matsumura*).

¹ Also called *ushi-koroshi* (*Pourthiaea villosa* Dcne.).

LASIOCAMPIDÆ

Genus COSMOTRICHE Hübner

Cosmotriche HÜBNER, Verz. Bek. Schmett. (1827), 188.

Cosmotriche potatoria Linnæus.

Plate II, fig. 1, larva; fig. 2, head; fig. 3, dorsal aspect.

Japanese name, *take-kareha*.

Bombyx potatoria LINNÆUS, Syst. Nat. (1767), 12, 813; LEECH, Proc. Zool. Soc. London (1888), 628, No. 232; Trans. Ent. Soc. London (1899), 113, No. 397; STAUDINGER and REBEL, Cat. Lep. Phal. (1901), 1, 122, No. 990; MATSUMURA, Cat. Insect. Jap. (1905), 1, 45, No. 368; Thousand Insects of Japan [Nihon Senchū Dzukai (Jap.)] (1909), suppl. 1, 88, No. 149, Pl. 12, fig. 6, ♀; GRÜNBERG, Seitz's Macrolep. Faun. Pal. (1911), 2, 164, Pl. 26f, ♂ and ♀.

Odonestis potatoria var. *askoldensis* OBERTHÜR, Etud. d. Ent. (1881), 5, 38; STAUDINGER, Rom. Mém. Léop. (1892), 6, 316; STAUDINGER and REBEL, Cat. Lep. Phal. (1901), 1, 122, No. 990a; GRÜNBERG, Seitz's Macrolep. Faun. Pal. (1911), 2, 164, Pl. 26f, ♂.

The larva figured (Plate II, fig. 1) was taken in May (figured May 31), 1902, at Hakodate, Oshima Province, Hokkaido, on bamboo grass, Japanese name, *sasa-kusa* (? *Lophatherum elatum* Zoll.). It pupated on July 4, and a female imago emerged on July 31, 1902. This female seems referable to var. *askoldensis* Oberthür. Another male, which emerged at Hakodate on August 4, 1902, from a larva compared with the foregoing figure (Plate II, fig. 1), seems to be nearer to typical *potatoria*, male. Both specimens are undoubtedly forms of *potatoria* Linn., not of *albomaculata* Brem., the larva of which, as Staudinger¹⁹ justly observes, is quite different from that of *potatoria*. Leech²⁰ remarks:

In the series of this species from Japan there are specimens which agree exactly with typical *potatoria*, Linn., and others which are most certainly identical with *O. albomaculata*, Brem., whilst between these two forms are aberrations, including a dark one near the variety *askoldensis* of Oberthür, which cannot be satisfactorily referred to either form; these serve as connecting-links and I think prove²¹ the identity of *O. potatoria* and *O. albomaculata*.

Grünberg²² says of *askoldensis*:

* * * larger and darker than the European specimens. It appears to be confined to the Ussuri district, East Siberia, for specimens from

¹⁹ Staudinger, Rom. Mém. Léop. (1892), 6, 317.

²⁰ Leech, Proc. Zool. Soc. London (1888), 628.

²¹ This, I think, is disproved by the difference in the larvæ of *potatoria* and *albomaculata*.—A. E. W.

²² Seitz's Macrolep. Faun. Pal. (1911), 2, 164.

Chabarovsk and Nicolaievsk, for instance, do not differ from the European form; however, small specimens, similar to the type-form are found also in the Ussuri district.

The following description of the larva of *Odonestis potatoria* Linn. is given by Wilson,²³ and my original figure of the larva (Plate II, fig. 1) agrees well with this description.

Larva. About three inches long, and hairy; dorsal area blue-grey, minutely irrorated with black, and speckled with bright yellow dots, some of these latter almost form a subdorsal line; on each side of the back is a row of short black tufts of hair; along each side is a series of larger tufts of white hair; above and between these white tufts there are a number of orange-colored spots and streaks; on each side of the second segment are two warts, from which proceed rather long tufts of hair, and there are long tufts of black hairs on the third and twelfth segments; the remaining hairs are pale yellowish-brown; spiracles buff; head speckled with two shades of yellow; legs and claspers hairy. Rolls in a ring when touched. [Great Britain, Wilson.]

Grünberg²⁴ describes the larva of *potatoria* as follows:

Larva blackish grey with a slight tinge of blue, dorsally with extended irregular yellow spots, which form stripes in very dark specimens; hair of body and head light brown. Dorsal tufts and brushes of hair black. The lateral hair spots white. In young larvæ the dorsal markings are bright orange-yellow. The larvæ emerge in August and first devour part of the egg-shell, afterwards feeding on hard grasses (*Carex*, *Dactylis*, *Luzula*), also on *Leontodon*. They hibernate after the third change of skin from the end of October, or November, until April, and are ready to pupate in June. The fusiform cocoon is pale yellow, being often attached to the stalks of *Sparganium* and *Phragmites*; pupa glossy dark brown, or blackish brown.

The length of my larva is about 70 millimeters, or nearly 2.75 inches.

It will be observed that Grünberg describes the larva as blackish gray with a slight tinge of blue. In my original figure this blue tinge is also slightly perceptible laterally. On segment 8 it is conspicuous, as just above the proleg on this segment a narrow transverse blue line commences, which encircles the body from side to side (Plate II, figs. 1 and 3).

Pupa.—The pupa is inclosed in a fusiform, dirty whitish brown cocoon of leathery texture attached to the stem of bamboo grass (*sasakusa*).

Local distribution.—Specimens of *potatoria* from the following localities are in my collection:

²³ Wilson, *Larvae of British Lepidoptera* (1880), 75, Pl. 15, figs. 1, 1a.

²⁴ GRÜNBERG, *Seitz's Macrolep. Faun. Pal.* (1911), 2, 164.

Honshu: Nikko, Shimotsuke Province, July 14, 1893, one male. Hokkaido: Hakodate, Oshima Province, August 4, 1902, one male, bred; July 31, 1902, one female, bred (= ? var. *askoldensis*); Junsai Numa and Tobetsu, Oshima Province, July, two males; Teshio, Teshio Province, July, one male; July 11, 1899, one female.

Time of appearance.—Larva, May; imago, July and August.

General distribution.—"Distributed from Japan over Siberia, Russia, Central and Northern Europe to Southern Italy and Spain; in the north to Finland." (*Grünberg*.)

Cosmotriche albomaculata Bremer.

Plate II, fig. 4, larva (form 1); fig. 5, food plant; fig. 6, larva (form 2); fig. 7, head; fig. 8, dorsal aspect; fig. 9, dorsal aspect of anal segment; fig. 10, larva (form 3); fig. 11, head; fig. 12, dorsal aspect; fig. 13, food plant.

Japanese name, *take-kareha*? *

Odonestis albomaculata BREMER, Bull. l'Acad. Pétr. (1861), 3; Lep. Ost. Sib. (1864), 42, Pl. 4, fig. 6, ♂; Pl. 3, fig. 20, ♀; STAUDINGER, Rom. Mém. Léop. (1892), 6, 317; STAUDINGER and REBEL, Cat. Lep. Pal. (1901), 1, 123, No. 991; GRÜNBERG, Seitz's Macrolep. Faun. Pal. (1911), 2, 164, Pl. 26g, ♀ (named *albimacula* in plate).

Odonestis potatoria Linnæus, LEECH, Proc. Zool. Soc. London (1888), 628, No. 232 (part.); Trans. Ent. Soc. London (1899), 113, No. 397 (part.); MATSUMURA, Cat. Insect. Jap. (1905), 45, No. 368 (part.); Thousand Insects of Japan [Nihon Senchū Dzukai (Jap.)] (1909), suppl. 1, 88, No. 149, Pl. 12, fig. 6, ♀ (*potatoria* Linn.), Pl. 12, fig. 8, ♀ (var. *albomaculata*) (part.); SASAKI, Insects Injurious to Japanese Trees [Nihon Jūmoku Gaichuhen (Jap.)], 3d ed. (1910), pt. 3, 118, Pl. 217, larva, pupa, imago, ♂.

Three forms of the larva are figured.

Form 1.—Laterally yellowish in color; length, 63 millimeters (Plate II, fig. 4). This larva was taken at Yoshino, Yamato Province, Honshu, in September (figured September 12), 1900, on *kaya*, a species of reed grass (? *Torreya nucifera* S. & Z.). The larva died, so that no imago was bred from it. I have observed this form on several occasions and think that it is merely a light form of the larva of *albomaculata*, although I failed to breed it. One often sees the larvæ of this species basking in the sun on mountain paths, having crawled down from adjacent bamboo grass for a tour of inspection; they vary much in shades.

* Matsumura gives this name to both *C. potatoria* Linn. and *C. albomaculata* Brem., as he regards the latter species as a variety of *potatoria*.

Form 2.—Laterally purplish gray; length, 66 millimeters (Plate II, figs. 6 to 9). This larva was taken at Hakodate, Oshima Province, Hokkaido (Yezo), in June (figured June 21), 1902, on bamboo grass, Japanese name, sasa-kusa (? *Lophatherum elatum* Zoll.). It pupated on July 4, and a male imago of *albomaculata* Bremer emerged on August 3, 1902. One male and two females were also bred from larvæ compared with this figure (Plate II, fig. 6). The male of these three specimens emerged on August 11, and the two females on July 31 and August 6, 1902, respectively. In the male the upper spot of the forewing is almost obsolete, being a mere dot (much smaller than in Bremer's figure); otherwise these three specimens agree well with his figures of the male and the female. The larva with the purplish gray sides is the commonest form met with, and I have frequently bred *albomaculata* from it.

Form 3.—Dark form; length, 71 millimeters (Plate II, figs. 10 to 12). This larva was taken at Hakodate in August (figured August 11), 1902, also on bamboo grass like the larva of form 2. It died before pupation, so that no imago was bred. This form (fig. 10) is nearer than forms 1 and 2 (Plate II, figs. 4 and 6) to the very dark larva of *potatoria* Linn., which is figured by me (Plate II, fig. 1).

Pupa.—The pupa is inclosed in a fusiform yellow cocoon of leathery texture, which is attached firmly to the stems of sasa (bamboo grass), kaya (reed grass), or various other grasses. The cocoon is smaller than that of *C. potatoria*, which is dirty whitish brown. Both the larva and the cocoon of *albomaculata* urticate to a slight extent.

Some controversy arose between Leech²⁶ and Staudinger²⁷ as to whether *albomaculata* should be considered a separate species distinct from *potatoria* Linn. Leech included *albomaculata* as a synonym of *potatoria*; while Staudinger maintained that it was a distinct species, some of his proofs being based upon the difference between the larvæ of the two species.

As will be seen by a comparison of the figures of the larva of *C. potatoria* Linn. and the larva of *C. albomaculata* Brem., forms 1, 2 and 3, there is a considerable difference between the larvæ of the two species, and I am inclined to indorse Staudinger's opinion as to the claim of *albomaculata* to specific rank.

²⁶ Leech, *Trans. Ent. Soc. London* (1899), 118.

²⁷ Staudinger, *Rom. Mém. Lép.* (1892), 6, 317.

Staudinger gives the following description of the larva of *C. albomaculata*, which agrees best with my original figure of the larva, form 2 (Plate II, fig. 6).

The larva of *albomaculata*, of which Christoph sent me a very good prepared specimen, is very different from that of *potatoria*, especially differing also from those of *potatoria* of the Amur region of which I have two good specimens from Dörries. These are as dark as the darkest larvæ found in Europe in which sometimes the yellow spot-stripes "on the upper side appear very strongly marked almost like stripes. The larva of *albomaculata* has large, quadrate, orange-brown dorsal spots, edged around with white, on which stand four pairs of black hair tufts which are much shorter than in *potatoria*. Laterally (from the spiracles) and below the larva is brownish, also the legs. Here, in *potatoria* everything is dark, only laterally are there small orange stripes which are clothed below with white, or yellow, woolly hairs."

Grünberg²⁸ describes the larva of *albomaculata* as follows:

Larva with large orange-brown dorsal spots edged with white, and four tufts of hair at each side on segments 4 to 10 respectively, these being still shorter than in *potatoria*; laterally and ventrally brownish. Habits as in *potatoria*, likewise the shape and color of the cocoon.

Sasaki²⁹ gives descriptions and figures of the larva, the cocoon, and the male imago. He says that the larva, which feeds upon bamboo, appears about the middle of May. It is full-grown in June, and the imago emerges at the end of the same month.

Local distribution.—Common in Hokkaido (Yezo) and Honshu. Matsumura records *potatoria*, with which he includes *albomaculata* as a variety, from the same islands. I have in my collection six males and ten females of *albomaculata* captured and bred at the following localities: Tokyo, Musashi Province, and Kobe, Settsu Province, both in Honshu, and Hakodate, Oshima Province, Hokkaido, two males and nine females bred from larva of form 2, in June, July, and August. Yoshino, Yamato Province, Honshu, and Hakodate, Hokkaido, four females taken in June and July. Nikko, Shimotsuke Province, one female, taken in August.

Time of appearance.—Larva, May, June, July?, August, and September; imago, June to August.

General distribution.—Eastern Siberia (southern Amurland); Korea; Japan. (Grünberg.)

²⁸ Seitz's Macrolep. Faun. Pal. (1911), 2, 164.

²⁹ Sasaki, Insects Injurious to Japanese Trees [Nihon Jūmoku Gaichūhen (Jap.)], 3d ed. (1910), pt. 3, 118, Pl. 217.

EUPTEROTIDÆ

Genus *APHA* Walker

Apha WALKER, Cat. Lep. Het. (1855), 5, 1180.

Apha tychoona Butler.

Plate II, fig. 14, larva; fig. 15, head; fig. 16, dorsal aspect; fig. 17, food plant.

Japanese name, *obi-ga*.

Apaha tychoona BUTLER, Ent. Month. Mag. (1878), 14, 207; Ill. Typ. Lep. Het. (1878), 2, 18, Pl. 27, fig. 5; PRYER, Trans. Asiat. Soc. Japan (1885), 12, 51, No. 183; LEECH, Proc. Zool. Soc. London (1888), 627, No. 224; Trans. Ent. Soc. London (1898), 273, No. 28; MATSUMURA, Cat. Insect. Jap. (1905), 1, 46, No. 379; Thousand Insects of Japan [Nihon Senchū Dzukai (Jap.)] (1901), suppl. 1, 89, No. 151, Pl. 12, fig. 9, ♀; GRÜNBERG, Seitz's Macrolep. Faun. Pal. (1911), 2, 185, Pl. 29e, ♂, 29f, ♀; NAGANO, Nawa's Insect World [Konchū Sekai (Jap.)] (1911), 15, 91, Pl. 6, figs. 1-12; fig. 1, imago, ♂; fig. 9, larva; fig. 11, pupa, ♀; fig. 10, cocoon.

The larva figured (Plate II, fig. 14) was taken in August (figured August 14), 1902, at Hakodate, Oshima Province, Hokkaido (Yezo), on *shiro-utsugi*, also known as *kogome-utsugi* (*Stephanandra flexuosa* S. and Z.). Matsumura gives *utsugi* (*Deutzia scabra* Thunb.) as the food plant. This larva died, but I bred two male and one female imagoes from similar larvæ on August 19 and 23, 1902. The larva is very common at Nikko, Shimotsuke Province, Honshu, altitude 457 meters (1,500 feet) on *utsugi*, where I have taken it in some numbers in July and August. When molested it shakes its head violently from side to side.

The following description of the larva is taken from my original figure: Length, 50 to 55 millimeters. Head ruddy-brown with two white streaks on each lobe. Body blackish, clothed dorsally and laterally with dense fascicles of ruddy-brown hairs; subdorsal and midlateral lines of interrupted ochraceous-gray streaks; subspiracular grayish white patches on each segment between the fascicles of hair from 4 to 12; spiracles white; legs brown.

Pupa.—The pupa is inclosed in a loose, hairy cocoon.

Imago.—The imago varies greatly in color, as I have specimens showing the following shades: Whitish brown, grayish brown, olive-brown, purple-brown, and yellow.

Nagano gives descriptions and figures of the imago, the pupa, the larva, and the cocoon and structural details of the imago. He states that he took a larva of *Apha tychoona* on *sui-kazura*

(*Lonicera japonica* Thunb.), at the commencement of June, and that it commenced to spin its cocoon on June 14; on June 17 it changed into a pupa, and the imago emerged on July 5. He thinks that it is probably single-brooded and that it hibernates as an ovum.

Local distribution.—Hokkaido: Hakodate, Oshima Province, August (Wileman). Honshu: Nikko, Shimotsuke Province, August (Wileman); Tokyo, Musashi Province, July, September, October (Wileman). Kyushu: Nakato, Hyuga Province, July (Wileman). Matsumura records the species from Hokkaido, Honshu, Shikoku, and Kyushu.

Time of appearance.—Larva, June, July, and August; imago, July to October. Single- or double-brooded (?).

General distribution.—Japan only (Grünberg). Leech records it from Japan and from central and western China.

ILLUSTRATIONS

[Drawings by Hisashi Kaidô.]

PLATE I

FIGS. 1 and 2. *Dasychira conjuncta* Wileman.

1, imago, male (figured from the cotype); 2, head.

3 to 5. *Orgyia thyellina* Butler.

3, larva, dorsal view; 4, food plant; 5, larva, lateral view.

FIG. 6. *Cifuna confusa* Bremer, larva.

7. *Lymantria aurora* Butler, larva, female.

FIGS. 8 to 10. *Topomesoides jonasii* Butler.

8, pupa, suspended; 9, dorsal view; 10, abdominal view.

PLATE II

FIGS. 1 to 3. *Cosmotriche potatoria* Linnæus.

1, larva; 2, head; 3, dorsal aspect.

4 to 13. *Cosmotriche albomaculata* Bremer.

4, larva (form 1); 5, food plant; 6, larva (form 2); 7, head; 8, dorsal aspect; 9, dorsal aspect of anal segment; 10, larva (form 3); 11, head; 12, dorsal aspect; 13, food plant.

14 to 17. *Apha tychoona* Butler.

14, larva; 15, head; 16, dorsal aspect; 17, food plant.

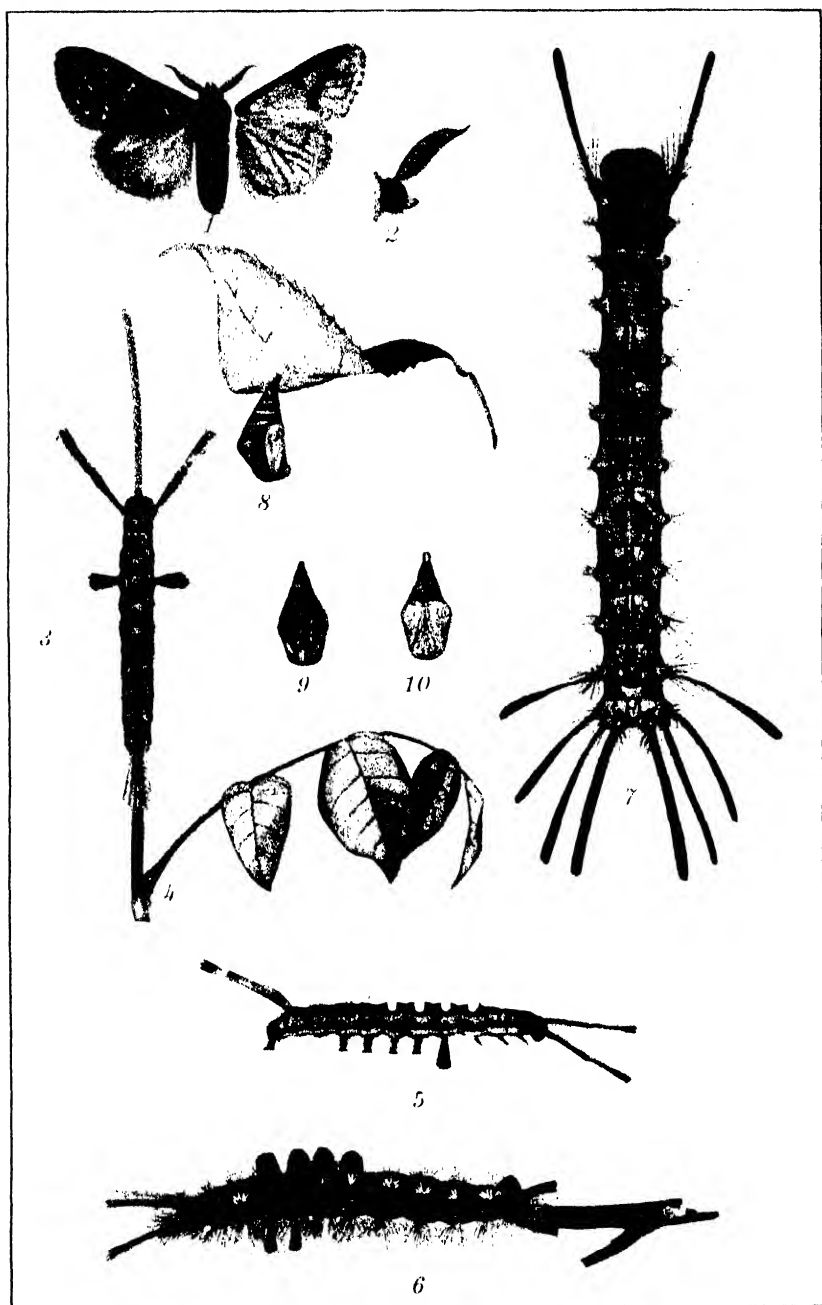


PLATE I. *DASYCHIRA CONJUNCTA*, *ORGYIA THYELLINA*, *CIFUNA CONFUSA*, *LYMANTRIA AURORA*, AND *TOPOMESOIDES JONASSII*.

REVIEW

Outlines | of | Comparative | Anatomy | of | Vertebrates | by | J. S. Kingsley
| professor of zoölogy in the University of Illinois | second edition,
revised | with 406 illustration | largely from original sources |
Philadelphia | P. Blackiston's Son & Co. | 1012 Walnut Street. Cloth,
pp. i-x—1-449. Price, \$2.50 net.

This most excellent work recently came to hand for a review, although the first edition had been seen earlier and the second edition used.

Beginning as he does with an introductory treatment of embryology and histology, the author paves the way in a pleasing and helpful way for the study of the integument, the skeleton, the muscular system, nervous system, sensory organs, digestive organs, respiratory organs, organs of circulation, and the urino-genital system of vertebrates, and he finishes the treatment with a discussion of the nutrition and respiration of the embryo, foetal envelopes, a bibliography, a glossary, and a table of the roots of technical terms.

A word may be said regarding the attitude of the writer toward the student and toward the subject matter concerned. The work as we understand it is designed to be helpful to the student who is just beginning the study of comparative anatomy and also to be of value to the advanced student. The author has not feared being criticized for repeating certain fundamental facts for the benefit of the person with little preparation; still the work contains thorough and exhaustive treatments of the various structures described. A very admirable feature is the clearness with which all statements and explanations are made, and the profusion of illustrations adds greatly to the value of the work.

In whatever part of the book one reads, the same breadth of scope is found and consequently satisfactory treatment of the subject. Take, for example, the air, or swim, bladder. Its origin, development, and functions are thoroughly discussed, not only in one animal form, but in several forms. Immediately following the swim bladder there is, in its proper order, a discussion of the air-ducts and lungs. The origin, development, and functions are taken up comparatively in a very exhaustive

manner. The same treatment of the circulatory system of various vertebrates is given a large place in the book.

These few structures are mentioned to serve as examples of the method of treatment of all structures, and they illustrate the thorough and exhaustive method used throughout the whole volume. What is true of the structures cited is equally true for the various structures treated.

Because of the pleasing and thorough manner in which the book is written, we feel like giving it our hearty indorsement, and in spite of any minor defects the work commends itself strongly to us.

ARTEMAS L. DAY.

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THE PROTOZOA OF MANILA AND THE VICINITY: I

By FRANK G. HAUGHWOUT *

*(From the Department of Medical Zoölogy, College of Medicine and Surgery,
University of the Philippines)*

The student of general zoölogy passes from group to group of the animal kingdom, and in his journey he reviews the

Edens that wait the wizardry of thought,
Beauty that craves the touch of artist hands,
Truth that but hungers to be felt or seen;

until either he pauses at, or goes back to, some group, which has touched his æsthetic sense or stirred his lust for scientific knowledge, and forthwith he becomes a specialist. Probably few men or women who pursue a specialty in natural history are not led to it by some prompting, perhaps very subtle, of the æsthetic sense, which has had its influence in determining them to make a life study of some particular group. To such persons the Protozoa are particularly alluring. Their beauty and variety of form are infinite; their life processes, whether carried out by the most primitive rhizopod or the most complex infusorian, abound with interesting phenomena; and the problems they afford are as profound and fascinating as they are varied and intricate.

Interest in the Protozoa is not restricted to the naturalist or the physician. They offer a fertile field to the amateur microscopist, and indeed, in the past, they have claimed the attention of that person more than they do in this day. Some very important contributions to the study of the morphology of species

* Professor of protozoölogy and chief of department.

of protozoa have been made by amateur workers. There is scarcely a person whose interest may not be stirred if given the opportunity to watch the rangings of protozoa through the microscopic jungles. The series of papers of which this forms the first is aimed as much to stimulate the interest of the amateur microscopist in a study of our local species of protozoa and a search for new species, as it is designed to be of aid to the general zoölogist and the workers in medicine and other allied fields.

The question "What is a protozoön?" has been answered in a number of ways by different writers. Colloquially they are generally spoken of as "single-celled animals," "the simplest forms of animal life," or "man's ultimate ancestor," definitions that, in the light of our present knowledge of these organisms, are decidedly inadequate. One of the best, if not the best because it is so comprehensive, is that of Calkins,¹ which is as follows:

A protozoön is a primitive animal organism usually consisting of a single cell, whose protoplasm becomes distributed among many free living cells. These reproduce their kind by division, by budding, or by spore formation, the race thus formed passing through different form changes and the protoplasm through various stages of vitality collectively known as the life cycle.

A brief analysis of this definition should serve to bring out several points, which it is important should be borne in mind by any person who undertakes the study or identification of protozoa.

A protozoön is a primitive animal organism.—The Protozoa are primitive in the sense that their organization as compared with the Metazoa is relatively simple. They have no organic, circulatory, or nervous systems as we understand those things by a study of animals higher in the scale. Their life processes are wholly of a cellular nature, but notwithstanding this they exhibit all the physiological functions manifested by the higher animals. They are considered as animals because, among other things, the animal type of nutrition predominates among them. There are, to be sure, certain species found among the Mycetozoa and the Phytomastigophora that show marked plant characteristics, but which, at the same time, show sufficient animal characteristics to justify their classification with the latter group.

Usually consisting of a single cell.—In a general sense a protozoön taken at random at some stage in its life cycle is a single-

¹ Calkins, G. N., Protozoölogy. Lea & Febiger, Philadelphia (1909), 17.

celled (or, if we accept Dobell's view, a noncellular) organism; but there are many species that tend to group themselves in more or less permanent colonies. Under such circumstances the colony is frequently spoken of as if it were an individual. However, when comparing the protozoan individual to the metazoan individual, the tendency is to consider the entire race produced between successive fertilization processes in the protozoön as being equivalent to the individual metazoön. This view, as Dobell points out, is open to serious question.

Whose protoplasm becomes distributed among many free living cells.—In the process of reproduction, and this varies greatly among the Protozoa, the original cell completely loses its individuality, unless we except forms where the parent cell survives following a process of gemmation. As a rule, however, the original cell becomes divided into two or more individuals, each consisting of a portion of the protoplasm that originally constituted the parent cell. This process goes on in geometrical progression, accompanied by the usual growth phenomena, until the protoplasm of the first cell has literally become distributed among a large number of free daughter cells.

These reproduce their kind by division, by budding, or by spore formation.—Reproduction by division may either be by binary fission, in which the parent cell divides to form two daughter cells, which in time grow to resemble the parent cell; or by multiple fission, in which the parent cell divides to form many daughter cells, which later grow to the adult form. Budding involves the pinching off from the parent cell of buds of nucleated cytoplasm of varying sizes according to the species, the buds in time assuming the form of the parent. The parent cell may or may not survive. Spore formation is often an exceedingly intricate process, among the attendant phenomena being the encapsulation of the organism in a resistant cyst or spore case. Spore formation, in the true sense, is accompanied by a fertilization process.

The race thus formed passing through different form changes.—Therein lies one of the greatest obstacles to the amateur systematist in his work with the Protozoa. It brings to mind the dictum of Schaudinn, "Die Kenntniss der Entwicklung ist das erste Postulat der Protozoenforchung," to which Calkins has added: "Until the full life history is known we can only place forms provisionally and with the understanding that further research alone will establish finality." The experienced protozoölogist has little trouble in recognizing the com-

moner species, but even there the principle does not fall, because he is able to recognize them at any stage of their life cycle. Compared with the whole, especially in regard to the Sarcodina and Mastigophora, the number of species in which it is possible to do this unerringly is not so large as might be imagined. *Paramecium* seen a few times is generally quickly recognized even by the student, and the same may be said of *Vorticella*, *Spirostemum*, or some of the other relatively monomorphic species. But there are many protozoa that may be amoeboid at one stage in their life cycle and flagellated at another; or witness the numerous striking form changes in *Plasmodium*, *Coccidium*, *Polystomella*, or even as familiar a form as *Arcella* during the course of their life cycles. These changes in form are of such a pronounced nature in some species as to lead the inexperienced worker to designate as a new species a cell that may merely represent a stage in the life cycle of some already well-known species. Such mistakes have been even committed by experienced workers. No species of protozoa is absolutely monomorphic. Some, it is true, have a very stable morphology, but even there polymorphism may express itself in no more pronounced way than in slight but none the less constant variations in size at definite periods of the life cycle.

The placing of a protozoön in one of the great groups may even involve the arbitrary naming of some stage in its cycle as the "adult" stage. The determining of the protozoan adult is not nearly so simple a matter as it is in the case of the metazoön, where sexual maturity is a convenient landmark, and it sometimes happens that a given species may be placed in either one of two subphyla with perfect propriety. This is particularly true of some of the simpler amebæ and flagellates.

And the protoplasm through various stages of vitality.—In other words, the physiological vigor and activity of the organism is not constant throughout its entire life cycle. This introduces the question of the immortality of the protozoan cell, which was raised by Weismann in his contention that every protozoön was a potential germ cell. This view has been vigorously combated by Calkins, who has reviewed the situation in a paper² following that of Woodruff and Erdmann³ on "endomixis" in *Paramecium*.

² Calkins, G. N., Cycles and rhythms and the problem of "Immortality" in *Paramecium*, *Am. Naturalist* (1915), 49, 65.

³ Woodruff, L. L., and Erdmann, Rhoda, A normal periodic reorganization process without cell fusion in *Paramecium*, *Journ. Exp. Zool.* (1914), 17, 425. Erdmann, Rhoda, and Woodruff, L. L., The periodic reorganization process in *Paramecium caudatum*, *ibid.* (1916), 20, 59.

Without entering into the details of this most interesting controversy, it may be said that there is abundant reason to believe that protozoa undergo physiological old age in common with other animals. The waning vitality, which accompanies this phenomenon, is restored and the animal rejuvenated by a process of fertilization, or, as it is frequently called, syngamy, which is probably of universal occurrence among the Protozoa. Fundamentally it seems to make little difference whether this process is one of autogamy, endogamy, exogamy, endomixis, or parthenogenesis. In every case the need for fertilization asserts itself ultimately and is met in some fashion, primitive or complex, and forms a most interesting stage in the life cycle of the protozoön. It should be borne in mind, however, that endomixis is merely a process of nuclear reorganization unaccompanied by synkaryon formation.

These, then, constitute the facts that are *collectively known as the life cycle*.

The study of the Protozoa is, therefore, seen to involve a study of morphology, physiology, and cytology with all their ramifications, which has led Calkins⁴ to define protozoölogy—

as that branch of the biological sciences which deals with the application of biological problems to, and with search for their solution in, the lowest group of animal organisms—the Protozoa.

The literature on the Protozoa is vast and is scattered through many publications. There are several textbooks and innumerable papers and monographs. The literature is found in the journals of zoölogy, botany, medicine, sanitation and hygiene, pathology and bacteriology, physiology and pharmacology, chemistry, genetics, anatomy, and occasionally in other scientific and semiscientific journals. At the end of this paper is appended a short list of some of the standard works on protozoölogy, which will be of aid to the student in the identification of species hitherto unreported in the Philippine Islands. No extended study of the world distribution of the Protozoa has been as yet undertaken, but for the most part they seem quite cosmopolitan, and I have found few fresh-water protozoa in the Philippines that were not familiar to me in the United States.

Collection.—The amateur collector will probably make his studies on forms collected at random. Really systematic work, however, entails a study of the ecology of the protozoa sought and a knowledge of the physical and chemical conditions in the

⁴ Calkins, G. N., The scope of protozoology, *Science* (1911), n. s. 34, 129.

environment in which they live. A recent paper by Hausmann⁵ contains some excellent hints for collecting and studying fresh-water protozoa. Directions for collecting rhizopods are given by Leidy⁶ in his great monograph, but are not so detailed as those given by Hausmann.

Material collected from natural sources should be studied as soon after collection as possible, especially if an enumerative study is to be made. Frequently striking morphological changes manifest themselves after protozoa have been transferred from their natural environment to artificial culture media, and studies of morphology and physiology made in artificial media should be carefully controlled and interpreted with great caution.

Cultivation.—In principle the successful cultivation of protozoa involves the discovery of the kind of food upon which the organism subsists and then supplying it with that food. This is often easier said than done. In the case of the parasitic forms the problem is particularly difficult; and many of them, especially the tissue-dwelling forms, have not yet been cultivated. As to nutrition the free-living forms may be holozoic, holophytic, or saprozoic. A given species may at one time be nourished by the holophytic method and later by the saprozoic; or nutrition in another may at one time be holozoic and at another saprozoic. Lauterborn⁷ has applied the term "sapropelic" to a characteristic fauna living under conditions of saprozoic and partly holozoic nutrition. These forms are found in fresh-water mud or ooze composed largely of the decaying remains of dead plants and similar débris. There are many predacious forms that feed wholly on other protozoa, and that must be distinguished from those that live on bacteria. Many of these predatory forms feed on some particular species and apparently select their food with great care. For instance, *Didinium nasutum* lives on *Paramecium*; *Spathidium spathula*, on *Colpidium colpoda*; *Actinobolus radians*, on *Halteria grandinella*, and so on. In the absence of the species that furnishes them with food they will quickly starve or encyst.

A large variety of fresh-water forms will live well in hay-infusion media. This may be prepared by boiling 1 gram of

⁵ Hausmann, L. A., Observations on the ecology of the Protozoa, *Am. Naturalist* (1917), 51, 157.

⁶ Leidy, Joseph, The Fresh Water Rhizopods of North America. Repts. U. S. Geol. Surv. of the Territories. Government Printing Office, Washington, D. C. (1879), 12, 8.

⁷ Lauterborn, R., Die "sapropelische" Lebewelt, *Zool. Anz., Leipzig* (1901), 24, 50.

timothy hay in 100 cubic centimeters of tap water for ten minutes, allowing it to stand uncovered for from twelve to twenty-four hours to allow for the growth of bacteria. Care must be taken that the water does not contain hypochloride of lime or any of the algicides. Pond or well water may be substituted. Distilled water is poor in oxygen, and in fact that constitutes a strong objection to boiled infusions, which likewise tend to become overgrown with bacteria that exert a deleterious effect on the protozoa. An interesting and suggestive paper on this subject has been recently written by La Rue.⁸ He makes his medium of sterile timothy hay and filtered tap water. The hay is made into small compact bundles, which are tightly wrapped in several layers of cheese cloth. The bundles are sterilized at from 15 to 17 pounds' pressure in the autoclave for fifteen minutes or more and then dried. This sterilization is intended mainly to kill encysted protozoa. It does not kill all bacteria. The tap water is filtered through filter paper into sterile containers, which should have the effect of removing many of the larger protozoa. It is my experience, however, that most of the smaller forms pass readily through filter paper. La Rue makes up his medium in the proportion of 10 grams of the sterile hay to 2 liters of the filtered tap water. These proportions, the author says, may be considerably varied. The original level of the fluid should be marked and maintained by the addition of filtered tap water from time to time. One or 2 grams of sterile hay may be added each week.

A refinement in the methods of cultivating free-living protozoa has been introduced by Hargitt and Fray⁹ in their method for sterilizing *Paramecium* and cultivating it with known strains of bacteria. Their paper is of great interest and significance in connection with experimental work, but the method is too difficult of application and, indeed, is not intended by the authors to apply to the maintenance of ordinary laboratory cultures. The principles brought out, however, are of interest to all workers who are dealing with the problems of the cultivation of protozoa.

Cultures of protozoa have been classified by Williams as being of three types:

Mixed cultures.—Those that contain the "omnium gatherum"

⁸ La Rue, G. B., Notes on the culturing of microscopic organisms for the zoological laboratory, *Trans. Am. Micros. Soc.* (1917), 36, 163.

⁹ Hargitt, G. T., and Fray, W. W., The growth of *Paramecium* in pure cultures of bacteria, *Journ. Exp. Zool.* (1917), 22, 421.

of pond or tap water; a heterogeneous mixture of protozoan, bacterial, and fungoid organisms mixed with lower metazoan forms such as Rotifera, Crustacea, and so forth. In such cultures a complex series of reactions can be generally observed accompanied by cyclic changes in the floral and faunal composition of the culture.

Pure mixed cultures.—These involve the cultivation of one species of protozoa in association with a pure strain of one other microorganism, such as a bacterium or some other protozoön. Although this is frequently referred to as a condition of symbiosis, such is not the case, for the associated organism serves as a source of food for the protozoön.

Pure cultures.—These are cultures of protozoa grown on a medium containing no other organism. The technic involved in the construction and maintenance of such cultures necessitates a close attention to conditions of asepsis and the employment of the methods of the bacteriologist.

Transitional between the last two methods may be said to be that by which certain protozoa may be grown in media sown with killed bacteria.

A great impetus was given to work with the parasitic protozoa through the introduction in 1903 by Novy and MacNeal¹⁰ of bacteriological methods in the cultivation of parasitic protozoa. The general tendency among protozoölogists to-day is to adapt the methods of the bacteriologist to the cultivation of free-living as well as parasitic protozoa. The strange thing about the whole affair lies in the neglect to do this to a greater extent in the past.

It would require too much space to detail the various methods for cultivating protozoa in a paper such as this. So far as may be possible, methods for cultivating individual species will be given in connection with the descriptions that will follow.

Study of the living organism.—A moderate degree of familiarity with the use of the microscope is presupposed in studies of this kind. The relatively quiescent forms such as the Sarcodina, sessile flagellates (Mastigophora), Sporozoa, and Suctorina (Infusoria) are kept in the microscopic field with comparative ease, particularly if the observer is using a mechanical stage. Actively moving flagellates and ciliates are often very

¹⁰ Novy, F. G., and MacNeal, W. J., On the cultivation of *Trypanosoma lewisi*. Contribution to medical research, dedicated to V. C. Vaughan. Ann Arbor, Mich. (1903), 549.

difficult to manage, for their vigorous movements usually carry them out of range of vision before one can focus on them and make out details of their structure. In such cases some colloid substance that will not harm the organism may be added to the medium. This has the effect of slowing their movements, though their cilia or flagella will continue to vibrate.

Among the substances that have been successfully employed are solutions of cherry tree gum or quince seeds, agar-agar, or carragheen. The latter substance may be obtained at any pharmacy. It is a dried and bleached seaweed, which consists mainly of *Chondrus crispus*, to which is added a small amount of *Gigartina mamillosa*. The substance is soaked in water, until it is converted into a slimy colloid mass. Small amounts may be introduced under the cover glass. Carragheen may be also added to the general culture, but it should be first washed in a 0.5 to 1 per cent solution of sodium bicarbonate. Remove the undissolved pieces at the end of a week or ten days. Change the water in the culture at the end of three or four weeks. *Paramecium* will live for months in such a medium. In the absence of other material gum arabic, gum tragacanth, or the like may be used. A solution of 3 grams of gelatin in 100 cubic centimeters of water gives good results.

On general principles morphological studies should be made in a medium as closely approximating that of the natural environment of the animal as possible. Parasitic organisms should be studied in the normal body fluid in which they occur. Use physiological salt solution and similar media with caution; they may or may not be isotonic to the species under observation. Failure to observe this caution may lead the worker to study and describe distorted instead of normal cells.

Motile organs, such as flagella and cilia, are often difficult to see in the living cell. In such cases one may use a drop or two of a strong solution of tannin or a bare trace of an alcoholic solution of sulphurous acid added to a watchglassful of medium containing the organisms. After the living organisms have been studied, a drop of weak solution of iodine and potassium iodide may be run under the cover glass, which will have the effect of bringing out the cilia and flagella and, frequently, many other parts.

Weak solutions of methyl green slightly acidulated with acetic acid often bring out important structures, particularly the nucleus. The acetic acid will generally cause the discharge of the trichocysts in such forms that possess them.

The gastric vacuoles may be studied in the living organism with very dilute solutions of neutral red or alizarin, added in small quantity to the medium containing the organisms. In connection with the use of intra vitam stains, it should not be expected that they will stain living protoplasm.

Occasionally, interesting results are obtained by adding an opaque material to the culture medium, which will have the effect of causing the organisms to stand out as bright, shining objects on a dark field. This affords an excellent method of studying the action of motile organs. Aniline black is one of a number of the aniline dyes that may be used for this purpose; diphenylamin blue is another. India ink has been used by many workers; it admits of observation of the discharge of the contractile vacuole. Avoid the presence of acid in cultures so treated. These substances may be used in combination with the immobilizing media previously mentioned.

Fixation and staining.—Though a study of the living animal under normal conditions should always precede a study of fixed and stained cells, it must be well borne in mind that staining brings out many important details that cannot be observed in the living cell. The nucleus, the form and finer structure of which is subject to considerable variation in the Protozoa, is seldom visible in any detail in the living cell. The technical treatment of the protozoan cell is not a simple matter. There are a multitude of methods that have been devised to meet special conditions, and it is, of course, impossible to go into this subject in any detail here. I shall be glad to correspond with any investigator who desires aid in connection with any special problem. A general method, which may be applied to the usual run of free-living and parasitic species, is given below.

To secure a good microscopical picture of the animal, the most approved cytological methods must be employed. With the exception of studies of the hæmatozoa, all staining must be done by the "wet method;" that is to say, the preparation must never be allowed to dry until it is sealed under the cover glass. Even with the blood parasites special "wet methods" have been devised that give infinitely better results from the cytological viewpoint than the old Romanowsky methods.

The best general fixative is sublimate-acetic fluid. It is made up as follows:

Saturated solution of mercuric chloride in sea water	
(per cent)	95
Glacial acetic acid (per cent)	5

A good general stain, which often gives an excellent cytoplasmic effect in addition to the nuclear stain, is the formula of Delafield, which is compounded thus:

Hæmatoxylin crystals (grams)	4
Ethyl alcohol, 95 per cent (cc.)	25
Saturated aqueous solution of ammonia alum (cc.)	400

Dissolve the hæmatoxylin in the alcohol and add it to the alum solution. Allow the mixture to ripen in the light in a bottle lightly stoppered with cotton. At the end of three or four days filter the solution and add:

Glycerin (cc.)	100
Methyl alcohol (cc.)	100

This solution should be allowed to ripen further for four or five weeks before using. It keeps well, but has a tendency to redden in the course of time. When this occurs, add a small amount of 1 per cent alum solution or a crystal or two of alum. The stain is best used in dilute solution, for it is very powerful and penetrating.

A useful formula is one that I have used extensively for many years as have several of my colleagues. This stain should be made up as follows:

Concentrated Delafield's hæmatoxylin (cc.)	10
Distilled water (cc.)	90
Glacial acetic acid (cc.)	0.5 to 1
Chloral hydrate crystal (gram)	0.5

Staining may be done with this mixture by either the progressive or the regressive method. It often gives a good flagellum stain by the progressive method. I have obtained some fine preparations of the malarial parasite by prolonged staining in the mixture.

The carmine stains often give brilliant results, especially if used after mercury fixation. Simple borax carmine or the picrocarmine of Hoyer, Ranvier, or Weigert are to be recommended, although I have secured my best results with Hoyer's formula. When staining by the regressive method with any of the hæmatoxylin or carmine stains named, differentiation should be carried out in 70 per cent alcohol very slightly acidified with hydrochloric acid.

This, of course, does not exhaust the list of methods that may be employed with the Protozoa. For others the reader must consult the general and special works on the Protozoa.

When protozoa are very abundant in a culture their collection and staining is a relatively simple matter. Under such conditions

I make use of what is called the round-bottom-vial method. Vials of from 5 to 8 cubic centimeters' capacity may be used. They should be filled to about two-thirds of their capacity with the fixing fluid, and material from a rich part of the culture should be transferred to them with a pipette. The organisms are instantly killed and fixed. When they have settled to the bottom of the vial, the supernatant fluid should be decanted or cautiously drawn off with a pipette, leaving the fixed organisms in a mass in the bottom of the vial. Alcohol of 70 per cent strength should be added, and when the organisms have again settled, this should be withdrawn and 95 per cent alcohol substituted. The organisms are allowed to settle once more. Keep the vial corked, especially in wet weather, to avoid absorption of water by the alcohol.

Slides are prepared by lightly smearing a little Mayer's albumen fixative over an area at the center of the slide about the size of a 5-centavo piece. This is made up by adding an equal quantity of glycerin to the white of egg, which has been previously well beaten. Add 1 gram of sodium salicylate to each 50 cubic centimeters of the mixture as a preservative. Mix and filter carefully before using.

A small quantity of the sediment from the bottom of the vial, together with a *minimum amount* of the alcohol, is then drawn up into a capillary pipette and forcibly spurted on the surface of the albumen film. The slide is then immersed in 95 per cent alcohol contained in a Coplin staining jar. From the time the protozoa are transferred to the slide until the preparation is finally sealed under the cover glass, the slide should never be allowed to dry. If it dries, the preparation is ruined. From the 95 per cent alcohol the slide is transferred to 70 per cent alcohol containing sufficient iodine to color it a port wine shade. It should remain there for ten minutes or possibly longer in order to remove the excess of mercury from the organisms. The iodine should be then washed out in 70 per cent clear alcohol and the slide passed down through 50 per cent alcohol to water by three- to five-minute stages. The preparation is then stained.

After staining, the slide is washed in tap water, is carried into 50 per cent alcohol where it should remain for three to five minutes, and finally is put into 70 per cent alcohol. Differentiation, when required, is carried out at this stage in the acidified 70 per cent alcohol before mentioned, the excess of acid afterward being thoroughly washed out in clear 70 per cent alcohol for at least fifteen minutes. After this the slide is passed through 95 per cent alcohol, 100 per cent alcohol, and xylol, five minutes in each change, and finally mounted in xylol Canada

balsam. The process of staining and differentiation should be carefully watched under the microscope in order that the required structural details may be clearly brought out. Some experience will be necessary to get good results, but if the beginner will observe and profit by his mistakes, he will soon be able to make passably good preparations.

In the case of blood parasites such as trypanosomes, malarial parasites, *Babesia*, and the like regular blood films should be made on a perfectly clean, grease-free slide. The films should be spread so as to avoid crushing the blood elements and the parasites. They should be quickly dried and then fixed for five minutes in absolute methyl alcohol. They may be then stained with Giemsa's solution. I believe that this is the best blood stain we have, but in its absence one may use Wright's, Hastings's, Jenner's, or any of the other standard formulæ. I carry out the process of staining with Giemsa's solution in shallow Petri dishes just large enough to hold the slides. The slides are supported, face down, on each end by a thin piece of glass, and the staining solution is run in between the bottom of the dish and the smeared surface of the slide with a pipette. By using this method the precipitations that tend to form from the blood stains will fall on the surface of the dish instead of being deposited on the slide to perplex the microscopist.

The Giemsa solution should be made up in distilled water, using one drop of the stock staining solution to each cubic centimeter of distilled water. Experience will show how long to stain the preparation. Five or six minutes will generally answer for trypanosomes, if the film be fresh. Fifteen minutes or even longer are required for intracorpuseular parasites. When the slide is stained, wash it quickly in a stream of distilled water, blot lightly with filter paper, and lean the slide up, face inward, until it is thoroughly dry. The preparation may be then mounted in Canada balsam, or it may be examined directly under the oil-immersion objective.

When protozoa are scarce in a culture, or it is desired to collect small surface-dwelling forms, cover glasses may be floated on the surface of the culture overnight and then transferred, face up, to a Syracuse watch glass containing fixing fluid. The process of staining, differentiation, dehydrating, and so forth may be carried on under the microscope in the Syracuse dishes in the same way that the slides were handled in the staining jars.

Individual protozoa of the larger species may be picked out of a watch glass containing them, with a capillary pipette, the operator working under a binocular microscope or Hastings's lens.

This requires a little experience and some knack, which are soon mastered. Investigators desiring to do embedding and sectioning are advised to consult the standard works dealing with those subjects.

In handling rich cultures of the small amœboid forms, such as *Vahlkampfia*, a drop of the medium containing the amœbæ may be placed on the surface of the slide. If the slide be laid aside in a moist chamber for a little while, the organisms will settle on to the glass, extend their pseudopodia, and remain there. The slide may be then immersed in the fixing fluid, when it will be found that the amœbæ will adhere firmly to the slide and will remain there through the subsequent manipulations. Many other small forms will do this—even some of the flagellates—but the larger species, particularly the ciliates, will almost always float off the slide and become lost.

Measuring.—Ideally, measurements should be made of the living organisms, but it is not always possible to do this because of the movements of the organism. The animals should be killed in a fluid that will not shrink, swell, or otherwise alter their form, and they should not be subjected to pressure such as that of the cover glass. Measurements of less than five hundred individuals have no great value. Care should be taken not to measure species outside of those it is desired to study, also to measure individuals in the same phase of the life cycle. In measuring small forms fixed on the slide, select only those that lie perfectly parallel with the surface of the slide—that is to say, do not measure the animal unless its entire surface is in perfect focus at one time.

Jennings¹¹ uses Worcester's fluid (saturated solution of mercuric chloride in 10 per cent formol, 9 parts; acetic acid, 1 part) or a chrome-osmic fluid made up in the proportion of 1 per cent osmic acid in 1 per cent chromic acid for killing and fixation. The animals are brought in a drop of fluid medium into a Syracuse watch glass and immediately overwhelmed with a large volume of the killing fluid. A portion of the fluid is then removed with a pipette, and 25 per cent glycerin is added, in which the cells are kept until they have been measured. The actual measurement is made with an Edinger drawing and projection apparatus. The organisms are transferred to a thin slide on a flat drop of the glycerin without a cover. They are then projected on to a drawing board and drawn and measured with

¹¹ Jennings, H. S., Assortative mating, variability and inheritance of size, in the conjugation of *Paramecium*, *Journ. Exp. Zool.* (1911), 2, 1.

a millimeter rule to a predetermined scale. By using a magnification of 500 diameters, each millimeter of the rule corresponds to $2\ \mu$ (0.002 millimeter).

In lieu of this, the organisms may be measured directly under the microscope by employing a stage micrometer and micrometer ocular; or they may be projected on to paper and drawn with the aid of a camera lucida.

This series of papers is designed to form the basis of a census of the Protozoa of the Philippine Islands and will, of course, deal with parasitic as well as free-living species. It is a task that at best will consume many years and certainly cannot be completed within the span of one man's life. I must, to a large extent, fall back upon the assistance of others, such as my colleagues, students, and other volunteer workers. Already I am indebted to several friends for reporting species that had not come under my notice. It is planned to acknowledge all such reports in this series. Such surveys have been made in many other places, generally under State support, and their value scarcely needs to be touched upon. The intimate relations of the Protozoa to problems in general biology, medicine, veterinary medicine, geology, physiology, pharmacology, and other sciences, as well as their importance as ultimate sources of food supply, has been so often pointed out that it is superfluous to make mention of them here.

There are at present no facilities in Manila for making studies of the marine forms found in neighboring waters, save some of the more easily obtainable plankton forms; therefore a study of the local Foraminifera¹² and Radiolaria will probably have to be indefinitely deferred.

The system of classification that will be followed is that set forth by Calkins.¹³ It has occurred to me to introduce some changes in classification and nomenclature made desirable through recent progress in the science, such as the abolition of the genus *Leishmania* and the incorporation of the organisms included within it in the older genus *Herpetomonas*, where it seems to belong; or the removal of the genus *Plasmodium* from the Hæmosporidia to the Coccidiida. Several changes are suggested in the Infusoria, particularly among the Hypotrichida,

¹² Cushman [*Proc. U. S. Nat. Mus.* (1911), 38, No. 1759] has made a study of a few species of arenaceous Foraminifera found in Philippine waters, in connection with the work of the Albatross Expedition of 1907-1910.

¹³ Calkins, G. N., *Protozoölogy*. Lea & Febiger, Philadelphia (1909).

and also some among the Rhizopoda, but pressure of other duties and lack of space make it seem undesirable to take up those matters here, so Calkins's classification will be adhered to throughout.

Many schemes of classification have been proposed for the Protozoa, and nearly every author of prominence has adopted a plan to meet his own ideas. The best of these systems have as their basis the organs of locomotion and their modifications. These define the principal groups or subphyla, further grouping being carried out on the basis of other characteristics. Under the system of Calkins, the phylum Protozoa is divided into four subphyla (classes of Minchin): the Sarcodina, or protozoa having pseudopodia as organs of locomotion; the Mastigophora, whose motile organs consist of flagella; the Sporozoa, having no special organs of locomotion in the trophic stages; and the Infusoria, having motile organs in the form of cilia. These groups will be further defined later on.

SUBPHYLA OF THE PROTOZOA

SARCODINA.—Protozoa having motile organs in the form of changeable protoplasmic processes known as pseudopodia. These may be either simple or supported by a central axial filament (p. 194).

MASTIGOPHORA.—Protozoa having motile organs in the form of one or more vibratile or undulating processes known as flagella (p. 199).

SPOROZOA.—Exclusively parasitic protozoa, reproducing mainly by spore formation (p. 203).

INFUSORIA.—Protozoa having motile organs in the form of flexible, vibratile protoplasmic processes known as cilia. These may be modified to form cirri, membranes, and membranelles. Dimorphic nuclei (macro- and micronuclei). Some forms are provided with tentacles in the adult stage (p. 208).

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CHARACTERS OF THE HIGHER GROUPS OF THE PROTOZOA

Subphylum SARCODINA.—Protozoa having motile organs in the form of changeable protoplasmic processes known as pseudopodia. These may be either simple or supported by a central rod of stiffened protoplasm,

Subphylum **SARCODINA**—Continued.

the axial filament. They range in form from those that are little more than minute masses of protoplasm to forms having elaborate shells, tests, and skeletal structures. They have no affiliations with the bacteria.

Class Rhizopoda.—The pseudopodia have no axial filaments and may be lobose, filose, or reticulose.

Subclass Proteomyxa.—Minute forms having soft, miscible pseudopodia. These anastomose when in contact with each other. Plasmodium formation may occur. This subclass includes many parasitic forms. Typical genus, *Plasmodiophora* Woronin, 1878.

Subclass Mycetozoa.—Single cells having pseudopodia. These frequently fuse to form complex plasmodia. This group is claimed by the botanists because of the fungi characteristics shown.

Order Acrasiae.—A pseudoplasmodium is formed through the union of the single cells. The cells do not fuse. This results in the formation of a plasmodium inclosed in a gelatinous mantle. Typical genus, *Copromyxa* Zopf, 1885.

Order Filoplasmodia.—There is no firm union of the cells. The connection is maintained by delicate protoplasmic threads. Typical genus, *Labyrinthula* Cienkowski, 1876.

Order Myxomyoetes.—The cells are completely aggregated. This often leads to the formation of complex fructifications in which the spores, which are frequently flagellated, are scattered by the aid of hygroscopic threads. Typical genus, *Fuligo* Haller, 1768.

Subclass Foraminifera.—The classification here follows that of Lister (1903). The classification of this group is very difficult, it being possible to place some genera under the order Testacea with perfect propriety. The pseudopodia are fine, branching, and frequently anastomose. The shells may be chitinous, calcareous, siliceous, gelatinous, or arenaceous; frequently they are very complex. The Foraminifera includes a large number of marine forms, some of them pelagic, others abyssal. Many creep about the surface, while some are sedentary. The shells may have many pores (Perforina), or may be without pores (Imperforina). They may be single-chambered (Monothalamous) or consist of many chambers (Polythalamous).

Order Gromiida.—The shells are single-chambered, chitinous, and generally without calcareous deposit. Simple in structure. Does not include the fresh-water testate forms. Typical genus, *Gromia* Dujardin, 1835.

Order Astrorhizida.—Arenaceous shells formed of particles of sand, mud, sponge spicules, etc., built up on a chitin base. The test is monothalamous, composite, and large. Lister groups four families under this order. Typical genus, *Astrorhiza* Sandahl, 1857.

Order Lituolida.—Arenaceous shells which are usually regular, mono- or polythalamous. According to Lister it comprises sandy isomorphs of hyaline or porcellaneous forms. Lister recognizes four families. Typical genus, *Lituola* Lamarck, 1801.

Subphylum SARCODINA—Continued.

Class Rhizopoda—Continued.

Subclass Foraminifera—Continued.

Order Miliolida.—Shells are calcareous and hyaline. They may be covered with sand or detritus. Lister notes six families. Typical genus, *Peneroplis* Montfort, 1810.

Order Textularida.—Arenaceous forms with or without perforated calcareous base. The chambers are arranged in one or two series. These may be irregular, alternate, or spiral. Three families. Typical genus, *Textularia* DeFrance, 1824.

Order Chilostomellida.—Finely perforated polythalamous calcareous tests. Lister names three genera. Typical genus, *Chilostomella* Reuss, 1860.

Order Lagenida.—The tests are similar to those of the Chilostomellida save for the monothalamous shell. However, this may be compounded by the union of chambers end to end in a straight or curved series. There are no canals and no canalicular skeleton. Four families. Typical genus, *Nodosaria* Lamarck, 1801.

Order Globigerinida.—Calcareous perforated tests. The few chambers are spirally arranged. No canals or canal systems. No division to families. Typical genus, *Globigerina* D'Orbigny, 1826.

Order Rotalida.—Calcareous perforated tests. Chambers are arranged in a spiral and all are visible from one aspect. The more highly developed forms have a canal system in some cases. Three families. Typical genus, *Rotalia* Lamarck, 1801.

Order Nummulitida.—Tests are bilaterally symmetrical (except in *Amphistegina*), calcareous, and filled with tubules. Canal system in the higher forms. Three families. Typical genus, *Polystomella* Lamarck, 1822.

Subclass Amebea.—Characteristic amoeboid forms, naked or testate. This subclass includes the most familiar rhizopods and notably those occurring as parasites of man. The pseudopodia are blunt or lobose and do not form anastomoses.

Order Gymnamebida.—The body is naked, though some forms show a hardening or condensation of the cortical plasma to form a membranlike envelope. This order includes several genera, among them being *Amæba*, *Entamæba*, etc., and, provisionally, *Neurocytes*.

Order Testacea (Thecamebida).—The organism is amoeboid but is invested with a definite membrane or test. This may be composed of a variety of substances cemented to a chitinous base. There is a single opening to the shell through which the pseudopodia are protruded. Typical genus, *Euglypha* Dujardin, 1841.

Class Actinopoda.—The pseudopodia are fine, raylike, and supported by a central axial filament of stiffened protoplasm, which may be extended from, or withdrawn into, the body. These rods are in close relation to the nucleus or nuclei and probably correspond to the kinetic element in the flagellum seen in the Mastigophora.

Subphylum **SARCODINA**—Continued.Class **Actinopoda**—Continued.

Subclass **Helliozoa**.—Mainly inhabitants of fresh water, few marine forms being known. They are characterized by the absence of a central chitinous capsule between the endo- and ectoplasm.

Order **Aphrothoraca**.—These forms are naked except during encystment. Typical genus, *Actinosphaerium* Stein, 1857.

Order **Chlamydomphora**.—The animal is invested with a felted fibrous or soft gelatinous covering. Typical genus, *Heterophrys* Archer, 1865.

Order **Chalarathoraca**.—The covering is siliceous and is made up of loosely connected or separate spicules. Typical genus, *Acanthocystis* Carter, 1863.

Order **Desmothoraca**.—The covering is of one piece and is perforated by numerous openings. Typical genus, *Clathrulina* Cienkowski, 1867.

Subclass **Radiolaria**.—These forms are characterized by the presence of a firm chitinous capsule separating the endo- and ectoplasm. This capsule is perforated in different ways for communication between the inner and outer plasm. Exclusively marine forms, pelagic or suspended at various depths. Some are abyssal. This classification is based on Haeckel's Challenger monograph.

Division **A. Porulosa**.—Spherical forms. The central capsule is spherical and is perforated by numerous minute pores.

Legion 1. **Peripylea** (*Spumellaria*).—The pores in the central capsule are evenly scattered. A skeleton usually is present; it is composed of scattered or fused spicules or of a latticed network.

Order **Collida** (Brandt).—With or without skeletogenous spicules. Solitary forms. Typical genus, *Thalassicolla* Huxley, 1851.

Order **Spherozoa** (Brandt).—Colonial forms. With or without skeletogenous spicules. Typical genus, *Collozoum* Haeckel, 1862.

Order **Spheroida**.—The skeleton occurs as one or several concentric spherical, latticed, or reticulate structures. Typical genus, *Actinomma* Haeckel, 1862.

Order **Frunoida**.—Characterized by spheroidal, ellipsoidal to cylindrical skeleton, single or concentric, occasionally constricted. Haeckel names seven families. Typical genus, *Druppula* Haeckel, 1887.

Order **Discoida**.—With discoidal to lenticular skeletons and central capsules. Haeckel names six families. Typical genus, *Cenodiscus* Haeckel, 1887.

Order **Larcoida**.—The skeleton, which is ellipsoidal with asymmetrical axes, forms almost a spiral in some cases. Haeckel names nine families. Typical genus, *Pylonium* Haeckel, 1881.

Order **Spheropylida** (Dreyer).—In addition to the usual distributed pores, there is one basal, or a basal and an apical opening to the central capsule. Typical genus, *Spheropyla* Dreyer, 1888.

Subphylum SARCODINA—Continued.

Class Actinopoda—Continued.

Subclass Radiolaria—Continued.

Division A. Porulosa—Continued.

Legion 2. Actipylea (Acantharia).—Here the pores are aggregated in definite areas. The skeleton consists, usually, of twenty spines of acanthin (strontium sulphate), which radiate from the center of the organism in a regular order (Mullerian law). These spines may branch to form a latticed shell.

Order Actinellida.—There are more than twenty radial spines. Haeckel names three families. Typical genus, *Xiphacantha* Haeckel, 1862.

Order Acanthonida.—The twenty spines are all equal in size and are arranged in regular order: four equatorial, eight tropical, and eight polar. Haeckel names three families. Typical genus, *Acanthrometron* Müller, 1855.

Order Spherophracta.—A complete fenestrated shell. Twenty equal, quadrangular spines. Haeckel names three families. Typical genus, *Dorataspis* Haeckel, 1860.

Order Prunophracta.—An ellipsoidal, lenticular, or doubly conical shell is present. The twenty radial spines are unequal. Haeckel names three families. Typical genus, *Thoracaspis* Haeckel, 1860.

Division B. Osculosa.—The form is monaxonic. The pores of the central capsule are limited to an area on the base, or to one such primary basal area and two secondary apical areas. These perforated areas of the central capsule are termed oscula.

Legion 3. Monopylea (Nassellaria).—The skeleton is siliceous. The central capsule consists of a single layer of chitin; it is sub-spherical to ovoid and is perforated at one pole only.

Order Nassoida.—The skeleton is absent. Haeckel names one family. Typical genus, *Nassella* Haeckel, 1887.

Order Plectoida.—The skeleton is formed of three or more spines, which radiate from one point below the central capsule or from a central rod. Members of this order never form a complete latticed skeleton. Haeckel names two families. Typical genus, *Triplecta* Haeckel, 1881.

Order Spyroida.—A lower chamber may be added to the shell. The skeleton consists of a sagittal ring and a latticed shell that is furrowed in the sagittal plane. Haeckel names four families. Typical genus, *Dictyospiris* Ehrenberg, 1847.

Order Stephoida.—The spines fuse to form one or more rings, which compose the skeleton. Haeckel names four families. Typical genus, *Lithocircus* Müller, 1856.

Order Botryoida.—The skeletons are similar to those in the order Stephoida, but they have, in addition, another wing-like process or lobe and one or more additional chambers. Haeckel names three families. Typical genus, *Lithobotrys* Ehrenberg, 1844.

Order Cyrtoida.—The skeletons lack the lobes or furrows, but are in other respects similar to those in the order Botryoida. Haeckel names twelve families. Typical genus, *Theoconus* Haeckel, 1887.

Subphylum SARCODINA—Continued.

Class Actinopoda—Continued.

Subclass Radiolaria—Continued.

Division B. Osculosa—Continued.

Legion 4. Cannopylea (Pheodaria).—The skeleton is siliceous, the spicules or bars often being hollow. There is a double central capsule of chitin, which has a spoutlike main opening at one pole and frequently one or more accessory openings at the opposite pole. Dark pigment granules, spoken of as *pheodium*, are found in the extracapsular protoplasm.

Order Pheocystina.—The skeleton may be absent. When it is present, it consists of distinct spicules. The central capsule lies in the center of the body, which is spherical. Haeckel names three families. Typical genus, *Aulactinium* Haeckel, 1887.

Order Pheospheria.—The skeleton is a simple- or double-latticed sphere. The central capsule occurs in the geometrical center of the body. Haeckel names four families. Typical genus, *Orosцена* Haeckel, 1887.

Order Pheogromia.—The central capsule is excentric, lying in the aboral half of the cell. The skeleton is composed of a simple latticed shell, which has a large opening at one pole. Haeckel names five families. Typical genus, *Pharyngella* Haeckel, 1887.

Order Pheoconchia.—The skeleton is characterized by the presence of two valves, which open in the same plane as the three openings of the central capsule. Haeckel names three families. Typical genus, *Concharium* Haeckel, 1879.

Subphylum MASTIGOPHORA.—Protozoa having motile organs in the form of one or more vibratile or undulating processes known as flagella. These are in relation to bodies of nuclear or centrosomic nature such as the kintonucleus or the blepharoplast," which may lie free in the cytoplasm or inside of the nucleus. Forms found in the orders Trypanosomatida and Polymastigida may have undulating membranes of a kinetic nature, bordered by a flagellum. Many species show marked plant characteristics, and some of the more primitive forms are closely allied to the bacteria.

Class Zoömastigophora.—Mastigophora having predominant animal characteristics.

Subclass Lissoflagellata.—Lacking protoplasmic collars and having "smooth" bodies.

"Minchin regards the blepharoplast as "a centrosome which is in relation to a motor cell-organ." It is not to be regarded as a kintonucleus any more than the latter is to be looked upon as the equivalent of the micronucleus of the Infusoria. Swezy [*Univ. Calif. Pub. Zööl.* (1916), 16, 185] has recently discussed the kintonucleus in relation to Hartmann's Binucleata and the parabasal body of the Polymastigida. Kofoid and McCulloch [*Univ. Calif. Pub. Zööl.* (1916), 16, 118] regard the kintonucleus as in reality the parabasal body or kinetic reservoir, which fluctuates in the volume of its substance with the changing internal conditions and motor activities of the organism.—F. G. H.

Subphylum **MASTIGOPHORA**—Continued.Class **Zoömastigophora**—Continued.Subclass **Lissoflagellata**—Continued.

Order **Spirochætida**.—The systematic position of this group is still unsettled, and they are grouped with the flagellates largely as a matter of convenience. The tendency is to place them in a group intermediate between the Protozoa and the Bacteria. However, that question cannot be entered into here. These organisms have spiral, *flexible*, somewhat plastic bodies, through which the chromatin is distributed in the form of granules, or blocks, or possibly as a helix. Some forms are described as having a crista or nonkinetic membrane running along the body and superficially resembling the undulating membrane of the trypanosomes, to which, however, it is not analogous. Transverse and longitudinal division is described. Other writers describe a multiple transverse division (granule formation) or the formation of coccoid bodies. Life histories are very incomplete. The order includes many parasitic species, some of which are highly pathogenic. Others are free-living. Typical genera: *Spirochæta*, *Cristispira*, *Saprospira*, *Treponema*, and *Leptospira*.

Order **Monadida**.—Mastigophora of the simpler type. The bodies are plastic and sometimes amœboid. One or more flagella occur at the anterior end. Many saprozoic forms. The holozoic forms have no definite mouth opening, the food being driven down to the base of the flagellum and ingested by a specialized area of soft protoplasm at that point.

Family **Rhizomastigidæ**.—The body is amœboid. The pseudopodia may be lobose like the Rhizopoda or axial as in the Actinopoda. There are one or two flagella. The flagella and pseudopodia cooperate in food-taking. Typical genus, *Mastigamœba* Schultze, 1875.

Family **Cercomonadidæ**.—There is no actual pseudopodia formation, but the cells are frequently very plastic and changeable in form. There is one flagellum with a flagellum-fissure at its base. Nutrition is holozoic or saprozoic. The family includes many parasites. Typical genera: *Cercomonas* Dujardin, 1841; *Herpetomonas* Kent, 1880; *Leishmania* Rogers, 1905.

Family **Codonocidæ**.—Minute, colorless "monad" forms. They secrete and remain in membranous or gelatinous cups. Typical genus, *Codonoca* James-Clark, 1866.

Family **Bikecidæ**.—The base is broader than the anterior extremity and bears a tentaclelike process. The individuals are minute and may form colonies. Nutrition is holozoic. Typical genus, *Poteroiodendron* Stein, 1878.

Family **Heteromonadidæ**.—Minute, colorless "monads" that, in addition to the principal flagellum, possess one or more accessory flagella. They frequently give rise to beautiful colonies, which form on a common stalk. Typical genus, *Anthophysa* St. Vincent, 1824.

Order **Heteromastigida**.—The distinguishing characteristic of the order is the possession of two or more flagella, one of which is

Subphylum **MASTIGOPHORA**—Continued.Class **Zoömastigophora**—Continued.Subclass **Lissoflagellata**—Continued.Order **Heteromastigida**—Continued.

directed forward and the other or others directed downward and backward—the so-called heteromastigote types. The forward flagellum is used in locomotion. The bodies are naked and plastic or provided with a highly differentiated membrane.

Order **Trypanosomatida**.—Exclusively parasitic forms of vertebrates and some invertebrates. Those found in the blood of mammals may have a stage in the life cycle occurring in some arthropod, or an arthropod may be the direct or mechanical transmitter.¹⁵ Trypanosomes of fishes in many instances are transmitted by leeches. These organisms are elongated, usually pointed at each end, and have one or two flagella arising from the kinetomotor nucleus. There is an undulating membrane, bordered by a flagellum, running from the kinetocore at the posterior end to the anterior end, where the flagellum is usually continued as a free lash. This undulating membrane is believed to be supplied with myoneme fibrils. In addition, there is a trophocore, which regulates the vegetative functions of the cell. A large group, of which the complete life history is known in no case. Typical genera: *Trypanosoma* Gruby, 1841; *Trypanoplasma* Laveran and Mesnil, 1904.

Order **Polymastigida**.—This order is characterized by species having numerous flagella, which may be arranged in groups. There may be one or many mouth openings, which are usually situated at the bases of the flagella. Some forms possess undulating membranes of a type similar to that seen in *Trypanosoma*. These may be bordered internally by a parabasal body. The order includes many parasitic species.

Tribe 1. **Astomea**.—The flagella are numerous and uniformly distributed. There are no special mouth openings. Typical genus, *Multicilia* Cienkowski, 1881.

Tribe 2. **Monostomea**.—The mouth opens at the base of a group of from three to six flagella. Typical genus, *Trichomonas* Donne, 1837.

Tribe 3. **Distomea**.—There are two groups of flagella with a mouth opening at the base of each. Typical genus, *Hexamitus* Du Jardin, 1838.

Tribe 4. **Trichonymphinae**.—Parasitic forms found in the digestive tracts of termites. They are covered with a coating of long flagella. There is a stout pyriform organelle, developed apparently in connection with the nucleus, which bears a similarity to the parabasal body of *Trichomonas*. Typical genus, *Trichonympha* Leidy, 1877.

Order **Euglenida**.—Large, free-living forms having one or two flagella. The body is contractile, showing the metabolic or euglenoid movements, with often a complicated body wall. There is a mouth and pharyngeal opening at the base of the flagella, which

¹⁵ It is to be doubted if true trypanosomes ever occur as parasites of non-blood-sucking arthropods.

Subphylum **MASTIGOPHORA**—Continued.Class **Zoëmastigophora**—Continued.Subclass **Lissoflagellata**—Continued.Order **Euglenida**—Continued.

is the point of discharge of the contractile vacuole. Some forms possess chromatophores, and colony forms occur.

Family Euglenidæ.—These are elongated, more or less pointed, and usually possessed of but one flagellum. Spiral stripings along the body show the course of the myonemes. Green chromatophores and red pigment eyespots or stigmata are usually present, as are pyrenoids and granules of paramylum. Typical genus, *Euglena* Ehrenberg, 1830.

Family Astasiidæ.—Body is colorless, elongate, and usually provided with a striped membrane. Eyespots (stigmata) absent. Otherwise they resemble members of the family Euglenidæ. Typical genus, *Astasia* Ehrenberg, 1838.

Family Peranemidæ.—Bodies usually symmetrical and either stiff or plastic. Typical genus, *Peranema* Dujardin, 1841.

Order Silicoflagellida.—Forms found parasitic on Radiolaria. They are of simple structure, having a peculiar latticelike silica skeleton and one flagellum. Typical genus, *Distephanus* Stöhr, 1881.

Subclass Choanoflagellata.—These forms are distinguished by a protoplasmic collar, which surrounds the base of the flagellum, which may be extended from, or withdrawn into, the body. They are simple in structure. Colonies, which are frequently formed, are embedded in a chitinous or gelatinous matrix.

Class Phytomastigophora.—Mastigophora, having marked plant characteristics. The class includes many complex colony forms in which there is division of labor and sexual dimorphism. The individual cells composing these colonies are always of simple structure, possessing eyespots, pyrenoids, and chromatophores, which may be brown, yellow, or green.

Subclass Phytoflagellata.—The chromatophores are yellow or green.

Order Chrysophagellida.—The chromatophores are yellow. Typical genus, *Synura* Ehrenberg, 1833.

Order Chlorophagellida.—The chromatophores are green. Typical genus, *Pleodorina* Shaw, 1894.

Subclass Dinoflagellata.—The organisms have an outer shell of cellulose in the form of plates and include many fresh-water and marine species, many of great beauty and some of bizarre form. Two furrows usually cut the body. Of these furrows the transverse is the most important. A flagellum lies in this furrow, while another is directed forward in advance of the organism. These flagella impart a rotation and forward movement at the same time. The organisms contain yellow or brown pigment.

Order Adinida.—There are no furrows, the flagella lying free in the water. The transverse flagellum has a movement the same as though the furrow were present. Typical genus, *Prorocentrum* Ehrenberg, 1833.

Order Diniferida.—Both longitudinal and transverse furrows are present.

Subphylum **MASTIGOPHORA**—Continued.Class **Phytomastigophora**—Continued.Subclass **Dinoflagellata**—Continued.Order **Diniferida**—Continued.

Family **Peridinidae**.—The shell may be absent. The transverse furrow is without wide ledges. Typical genus, *Peridinium* Ehrenberg, 1832.

Family **Dinophysidae**.—The borders of the transverse furrow are developed into great ledges, making a deep furrow for the flagellum. Typical genus, *Tripodoselenia* Kofoid.

Order **Polydinida**.—This order includes but one genus, *Polykrikos* Bütschli, 1873. It manifests some of the characteristics of members of the subphylum Infusoria in the possession of micro- and macronuclei and nematocysts. The body is naked and has several transverse furrows and flagella."

Subclass **Cystoflagellata**.—Exclusively marine forms including but three genera, *Noctiluca*, *Leptodiscus*, and *Craspedotella*. The body is highly parenchymatous with a firm membrane. A single nucleus. The young or "embryonic" stages are dinoflagellate. *Craspedotella* resembles a microscopic medusa, having a velumlike membrane on its under surface.

Subphylum **SPOROZOA**.—A group of protozoa, exclusively parasitic. Reproduction is mainly, but not invariably, by spore formation. The term spore formation as used here is to be taken in the broad sense as including asexual spore formation (schizogony) and spore formation following fertilization (sporogony). In a general sense the Sporozoa have no motile organs; but some of them, as the gregarines, are fitted with myonemes, which enable them to move with a vermiform motion. Some of the gametes are flagellated. In the Neosporidia pseudopodium formation occurs in some species. Simple division occurs among the Schizogregarines and forms an exception to the rule regarding spore formation as a characteristic of the subphylum. Members of the group in some instances show affinities with the Sarcodina and in others with the Mastigophora. It cannot be regarded as a stable group from the taxonomic viewpoint. The Gregarinida and the Coccidiida may be looked upon as well-established orders, but the remainder of the group, particularly in regard to the entire class Neosporidia, can, for the present, be regarded only as a catchall for species that cannot be properly placed until their full life histories are known. The classification, therefore, must stand as it is until that time arrives.

Class **Telosporidia** (Schaudinn).—The life of the individual ends with sporogony.

Order **Gregarinida**.—Reproduction usually confined to spore formation, which follows the union in fertilization of slightly differentiated gametes. Cœlozoic.

Suborder **Schizogregarinæ**.—In addition to spore formation, the individual may reproduce by division or by a process of multiple

"Kofoid [*Zool. Anz.* (1907), 31, No. 9-10, 291], in a review of the systematic position of *Polykrikos*, concludes that it is a colonial dinoflagellate of 2, 4, or rarely 8 zooids. He places it in the subclass Dinoflagellata, family Gymnodinidae, and subfamily Polydininae.

Subphylum SPOROZOA—Continued.

Class Telosporidia (Schaudinn)—Continued.

Order Gregarinida—Continued.

Suborder Schizogregarinae—Continued.

budding. Typical genera: *Schizocystis* Lèger, 1900; *Microtenella* Calkins, 1915.

Suborder Eugregarinae (Lèger).—Spore formation apparently is the sole method of reproduction. If division takes place at all, it occurs in the host cell during the "young" stages.

Tribe 1. Acephalinae (Kölliker).—No epimerite is formed. There is no division into chambers. Typical genus, *Monocystis* Stein, 1848.

Tribe 2. Cephalinae (Delage).—An epimerite is present at some stage in the life cycle. There is division of the body by a septum into protomerite and deutomerite. The trophozoites frequently associate in couples arranged tandem-fashion. These individuals are styled the primitive and satellite, respectively. Members of this tribe are found parasitic in the digestive tracts of Arthropoda.

Legion A. Gymnosporea.—No sporocysts or specially protected sporoblasts are formed, the sporozoites arising directly from the sporoblast mother cells.

Family Aggregatidae (Labbé).—There are a number of residual masses about which the sporozoites are irregularly grouped. Typical genus, *Aggregata* Frenzel, 1885.

Family Porosporidae (Labbé).—There are no protective sporocysts. Special centers (sporoblast centers) of sporozoite formation are present. Typical genus, *Porospora* A. Schneider, 1875.

Legion B. Angiosporea (Lèger).—Characterized by well-developed sporocysts. These have an inner and an outer coat, the endospore and episore, respectively.

Family Gregarinidae (Labbé).—The sporocysts may or may not have sporoducts. The spores are barrel-shaped or oval and in cases where sporoducts are present are united in strings. The trophozoites have a simple epimerite. Typical genus, *Gregarina* Dufour, 1828.

Family Didymophyidae (Lèger).—This family is characterized by the association of the sporonts in pairs. This epimerite of the satellite disappears, which gives the appearance of an organism having three chambers and two nuclei. Typical genus, *Didymophyes* Stein, 1848.

Family Dactylophoridae (Lèger).—The sporocyst opens by simple rupture or by the swelling of the "pseudocyst" or residual mass of plasm. The epimerite is irregular and asymmetrical and is fitted with digitiform processes. Typical genus, *Pterocephalus* A. Schneider, 1887.

Family Actinocephalidae (Lèger).—Sporonts have simple, symmetrical, or irregular appendages and are always solitary. The spores are biconical, cylindrical, or navicular. The cysts open by simple rupture. Found parasitic in the digestive tracts of carnivorous Arthropoda.

Group A. Sciadiophorinae (Labbé).—The protomerite is un-

Subphylum SPOROZOA—Continued.

Class Telosporidia—Continued.

Order Gregarinida—Continued.

Suborder Eugregarinae—Continued.

Tribe 2. Cephalinae—Continued.

Legion B. Angiosporea—Continued.

Family Actinocephalidae—Continued.

Group A. Sciadiophorinae—Continued.

brella shaped with radiating ridges. The spores, which are biconical, have central swellings. The epispore opens at the equator by simple dehiscence; the endospore opens terminally. Typical genus, *Sciadiophora* Labbé, 1899.

Group B. Anthorhynchinae (Labbé).—The spores are ovoid and have pointed ends. They are joined in strings. The opening is equatorial. Typical genus, *Anthorhynchus* Labbé, 1899.

Group C. Pileocephalinae (Labbé).—The epimerite is simple and regular; the spores are usually biconical. The cysts open by simple rupture. Typical genus, *Pileocephalus* A. Schneider, 1875.

Group D. Stictosporinae (Labbé).—The spores are biconical, with the points slightly incurved. The endospore bears papillae. Typical genus, *Stictospora* Lèger, 1893.

Group E. Actinocephalinae (Labbé).—The epimerite always bears appendages. The spores are regular, cylindrical, biconical, navicular, or subnavicular. Typical genus, *Schneideria* Lèger, 1892.

Family Acanthosporidae (Lèger).—The epimerite may be simple or may bear appendages. The sporonts are always solitary. The spores bear bristles at the equator or at the poles. The cysts open by simple rupture. Found parasitic in carnivorous insects. Typical genus, *Corycella* Lèger, 1892.

Family Menosporidae (Lèger).—The epimerite is symmetrical, bears appendages, and is connected with the protomerite by a long neck. The sporonts are solitary. The spores are in the form of more or less curved crescents. The spherical cysts open by simple rupture. Typical genus, *Menospora* Lèger, 1892.

Family Stylorhynchidae (A. Schn.).—Brown- or black-colored spores occurring in strings. The epimerite is symmetrical with or without appendages. The cyst has two envelopes and contains a pseudocyst. Typical genus, *Stylorhynchus* Stein, 1848.

Family Doliocystidae (Labbé).—Septum lacking. The epimerite is regular and simple. The oval spores have a polar thickening. Found parasitic in marine annelids. Typical genus, *Doliocystis* Lèger, 1893.

Order Coccidiida.—This order includes a large number of Sporozoa that are cytozoic and karyozoic. The life cycles include an alternation of generations in which a succession of schizogonous cycles gives way to sporogony. Following syngamy, the oösphere gives rise to sporoblasts, which may or may not be covered by a sporocyst membrane and which may develop one or several sporo-

Subphylum SPOROZOA—Continued.

Class Telosporidia—Continued.

Order Coccidiida—Continued.

zoites. In general, the life histories correspond to the life cycle for *Coccidium schubergi* as given by Schaudinn in his classical paper.¹¹ A group of rare interest.

Suborder Asporocystinea.—The sporoblasts form no sporocysts, the sporozoites forming directly from the oösphere.¹²

Family Eimeridæ (Asporocystidæ Leger).—Sporocysts are absent, the sporozoites lying unprotected in the parent cell. Typical species, *Eimeria nova*, parasitic in *Glomeris*.

Suborder Sporocystinea.—The sporoblasts are covered by a sporocyst membrane within which the sporozoites are produced.

Family Isosporidæ (Disporocystidæ Leger).—The oösphere gives rise to two sporoblasts with sporocyst coverings. Typical genus, *Isospora* A. Schneider, 1881.

Family Coccidiidæ (Tetrasporocystidæ Leger).—The oösphere gives rise to four sporoblasts with sporocysts. These are the true "Coccidia." Typical genus, *Coccidium* Leuckart, 1879.

Family Coccidiidæ (Tetrasporocystidæ Leger).—The oösphere gives rise to many sporoblasts with sporocysts. Typical genus, *Klossia* A. Schneider, 1875.

Order Hæmosporidia (Danilewsky).—An unsettled order including many members whose life histories are imperfectly known. It includes hæmatozoic parasites, cytozoic or cœlozoic in the blood stream of the vertebrate hosts. The affinities of some point to the Macrogophora and of others to the Coccidiida.

Suborder Acytoporeæ (Minchin).—Blood parasites of vertebrates in which the principal stages of the asexual cycle including schizogony are carried out in the host cell or corpuscle. Sporogony is completed in the alimentary tract or body cavity of some blood-sucking arthropod—an insect or arachnid, in the known cases. The parasite of malaria is at present included in this suborder. Typical genera: *Plasmodium* Marchiafava and Celli, 1885; *Babesia* Starcovici, 1893.

Suborder Hæmosporea (Minchin).—The Hæmogregarines. They are found parasitic mainly in cold-blooded animals. They are intracellular parasites in the blood, becoming free in the blood stream. There may or may not be an alternation of hosts. Typical genus, *Hæmogregarina* Danilewsky, 1885.

¹¹ Schaudinn, Fritz, Der Generationswechsel bei Coccidien, *Zoöl. Jahrbücher (Abth. f. Anat.)* (1900), 13, 197. Fritz Schaudinn's Arbeiten. Leopold Voss, Hamburg und Leipzig (1911), 208.

¹² It is probably only a matter of a short time before the genus *Plasmodium* will be removed from the order Hæmosporidia and placed in this group, where it obviously seems to belong. Franca [Journ. de Sciences Matematicas, Fisicas e Naturais, Ser. 8, No. 1 (1917), Lisbon: Imprensa Nacional; cited in *Trop. Vet. Bull.* (1917), 5, 231] has recently taken a definite step in this direction. He makes the Coccidia and Hæmosporidia suborders of the order Coccidiomorpha (Coccidiida) and breaks the Hæmosporidia up into four families: the Hæmogregarinidæ, the Plasmodiæ, the Piroplasmidæ, and the Toxoplasmidæ.

Subphylum SPOROZOA—Continued.

Class Neosporidia (Schaudinn).—These are parasites principally of vertebrate hosts, mainly fish, which lead a cytozoic, histozoic, or oölozoic life. Unlike the Telosporidia, spore formation does not end the life of the individual. Instead, sporulation of the parasites, which are amoeboid, takes place during the activity of the parent cell and does not interfere with the vegetative processes. Pansporoblast formation is of frequent occurrence.

Order Myxosporidia (Bütschli).—The individuals are relatively large and reproduce by pansporoblast formation. The spores are provided with polar capsules within which the threads may be easily seen.

Suborder Disporea (Doflein).—Each trophozoite produces one pansporoblast that contains two spores. The spores are wider than they are long. The trophozoites are found floating freely in the fluids of various organs of the fish and frog hosts.

Family Ceratomyxidae (Doflein).—Having the characters of the suborder. Typical genus, *Ceratomyxa* Thélohan, 1892.

Suborder Polysporaea.—Each pansporoblast produces two and usually a great number of spores. These spores are longer than they are wide.

Family Myxidiidae (Thélohan).—The spore has two polar capsules. Typically the trophozoites live as free parasites in the fluids of the internal organs of their hosts. Typical genus, *Myxidium* Bütschli, 1882.

Family Chloromyxidae (Thélohan).—The spores have four polar capsules. Typical genus, *Chloromyxum* Mingazzini, 1890.

Family Myxobolidae (Thélohan).—These forms are usually polysporous. Histozoic and usually found as cysts filled with spores. Amoeboid forms are rarely found. Vacuoles that take a reddish brown stain on treatment with iodine are found in the sporoplasm. Typical genus, *Myxobolus* Bütschli, 1882.

Order Microsporidia (Balbani).—More or less amoeboid trophozoites. The spores pyriform, very minute, and with only one polar capsule, the latter being invisible in the living organism. Parasitic in invertebrates, particularly Crustacea and other Arthropoda. Cytozoic.

Family Glugeidae (Thélohan).—Having the characters of the order.

Group A. Polysporogenea (Doflein).—Many pansporoblasts are produced by the trophozoite. Each gives rise to many spores. Typical genus, *Glugea* (*Nosema*) Thélohan, 1891.

Group B. Oligosporogenea (Doflein).—A single pansporoblast is produced by each trophozoite. Typical genus, *Gurleya* Doflein, 1898.

Order Actinomyxidia.—Members of this order are characterized by the possession of a double cellular envelope, three polar capsules, and eight spores that are arranged in ternary symmetry. Typical genus, *Hexactinomyxon* Stölz, 1899.

* Calkins comments: "The characteristics distinguishing these two suborders are not very definite and some more natural system should be worked out with further knowledge of the group. Under the polysporous forms, for example, *Sphaerospora* is exceptional in having nearly spherical spores."

Subphylum SPOROZOA—Continued.

Class Neosporidia (Schaudinn)—Continued.

Order Haplosporidia (Caull. and Mesnil).—A group of which little is known concerning either the life histories or affinities. They are grouped by Caullery and Mesnil as follows:

Family Haplosporidiidae (Caull. and Mesnil).—Parasites of annelids; of amoeboid form. They reproduce by encapsulated merozoites, which may bear spines or processes. Typical genus, *Haplosporidium* Caullery and Mesnil, 1905.

Family Bertramiidae (Caull. and Mesnil).—Includes two genera, *Bertramia* and *Ichthyosporidium*, and with four species parasitic in fish, annelids, and rotifers. Typical genus, *Bertramia* Caullery and Mesnil, 1905.

Family Celosporidiidae (Caull. and Mesnil).—Includes three genera: *Celosporidium* Mesnil and Marchoux, 1898; *Polycaryum* Stempel, 1901; and (?) *Blastulidium* Ch. Perez, 1903, mainly parasites of copepods. Doubtful forms, including the genera *Schewiakovella* Caull. and Mesnil, 1905, parasite of *Cyclops*, etc.; *Chytridiopsis* A. Schn., 1884, parasite of *Tenebrio molitor* and of *Blaps*; *Celosporidium* Crawley, of *Blattella germanica*; *Lymphosporidium* Calkins, 1898; and *Rhinosporidium* Minchin and Fantham, the cause of nasal tumors in man.

Order Sarcosporidia.—Parasites in muscle cells of vertebrates. The parasites occur in large sacklike spore cases (Miescher's tubules or Rainey's capsules) with double membranes. Erdmann²⁰ has described an amoeboid phase and schizogony in the case of *Sarcocystis muris*, of the mouse. Crawley²¹ counsels the removal of the Sarcosporidia to the Telosporidia on the conclusion that they are related to the Coccidiida. One genus, *Sarcocystis* Lankester, 1882.

Subphylum INFUSORIA.—The most highly developed of the Protozoa. The motile organs are in the form of flexible, vibratile, protoplasmic processes known as cilia. These differ from flagella in being shorter. The stroke, also, is different, being sharp and quick in the propulsive movement and slower and less forceful on the recovery. In some forms these cilia may be united to form cirri, membranelles, and membranes. The cilia may be permanent or they may be limited to young stages of the organism. Most forms show the presence of dimorphic nuclei, the macronucleus (meganucleus) and the micronucleus. Reproduction is by simple division, transverse to the long axis of the cell, or by budding. The nutrition is of the holozoic type—occasionally saprozoic.

Class Ciliata.—Cilia are present at all stages of the life cycle. Mouth and anal pore usually present. A complex canal system is often found in connection with the contractile vacuole. Reproduction by transverse division.

²⁰ Erdmann, Rhoda, Schizogony in the life cycle of *Sarcocystis muris*, *Proc. Soc. Exp. Biol. & Med.* (1915), 11, 152.

²¹ *Nature* (1917), 100, 250.

Subphylum INFUSORIA—Continued.

Class Ciliata—Continued.

Order Holotrichida.—Similar cilia uniformly distributed over the body.

These may lengthen about the mouth. Trichocysts may be distributed over the body or restricted to special areas.

Suborder Gymnostomina.—The mouth opens only during food-taking. There is no undulating membrane about the mouth.

Family Encheliniæ.—Mouth round or oval in outline and either terminal or subterminal. Food-taking is usually a literal act of deglutition. Typical genera: *Enchelys* Hill, 1752, Ehrenberg, 1838; *Actinobolus* Stein, 1867.

Family Tracheliniæ.—Body asymmetrical or distinctly bilateral. The dorsal aspect is slightly arched. Mouth terminal or subterminal and in some cases drawn out to form a long proboscis. When an œsophagus or gullet is present, it usually is supported by a framework of rods or a tubelike structure. Esophagus may be absent. Typical genus, *Dileptus* Dujardin, 1841.

Family Chlamydodontiæ.—Mouth usually in the posterior region. General body form kidney-shaped or oval. Mouth almost always open. Pharynx supported by a framework of rods or by a smooth, firm tube.

Subfamily Nassuliniæ.—The body is completely ciliated. Typical genus, *Nassula* Ehrenberg, 1833.

Subfamily Chilodontiniæ.—Body generally flattened. The cilia on the dorsal aspect are stronger, and they may be confined to that region. Typical genus, *Chilodon* Ehrenberg, 1833.

Subfamily Ervilliniæ.—The invariable characteristic is the presence of a movable style, which arises from the posterior ventral surface. The cilia are restricted to the ventral surface or to a portion of it. Typical genus, *Dystertia* Huxley, 1857.

Suborder Trichostomina.—The mouth or pharynx is bordered at its edge by an undulating membrane or membranes. The mouth is always open. Ciliation is general.

Family Chiliferidiæ.—Peristome area absent or at best only partially developed. Mouth in anterior half of the body or near the middle. When present the pharynx is short. Typical genus, *Colpoda* Müller, 1773.

Family Urocentridæ.—The cilia appear as two broad zones around the body at each end. Mouth is in the center of the ventral side and is fitted with a long tubular pharynx. Typical genus, *Urocentrum* Nitsch, 1827.

Family Microthoraciæ.—Small forms, asymmetrical, the mouth in the posterior region. Cilia generally dispersed, but occasionally limited to the oral region. One or two undulating membranes may be present. Typical genus, *Microthorax* Engelmann, 1862.

Family Parameiciæ.—There is a large triangular peristome, extending from the left anterior edge of the body to the mouth, which is sometimes in the anterior and sometimes in the

Subphylum **INFUSORIA**—Continued.

Class **Ciliata**—Continued.

Order **Holotrichida**—Continued.

Suborder **Trichostomina**—Continued.

Family **Paramecidae**—Continued.

posterior half of the body. Typical genus, *Paramecium* Stein, 1860.

Family **Pleuronemidae**.—A long peristome runs along the ventral side terminating at the mouth. The body is compressed laterally or dorso-ventrally. An undulating membrane borders the entire left edge of the peristome and sometimes extends around its posterior extremity to form a pocket leading to the mouth. A less highly developed membrane borders the other lip of the peristome. A well-developed pharynx may or may not be present. Typical genus, *Pleuronema* Dujardin, 1841.

Family **Isotrichidae**.—A group of interesting parasites found in the stomachs of ruminants. The group recently reviewed by Sharp² in an excellent paper. Some of the members of this group are of exceedingly complex structure. The bodies are plastic, the cuticle thick and provided with evenly distributed cilia. Mouth and distinct pharynx. The family includes the genera *Isotricha*, *Dasytricha*, *Bütschli*, *Cycloposthium*, and several others. Stein³ designated the Family **Ophryoscolecidae** to include organisms of the same general type. The student is referred to Sharp's paper for further information. Typical genus, *Isotricha* Stein, 1859.

Family **Opalinidae**.—The oval bodies may be short or even stumpy or they may be long and wormlike. Mouth and pharynx absent. Typical genus, *Opalina* Purkinje and Valentin, 1835.

Order **Heterotrichida**.—In organisms included in this order the ciliation is uniform. There is an adoral zone consisting of short cilia, which are fused to form membranelles.

Suborder **Polytrichina**.—The coating of cilia is uniform.

Family **Plagiotomidae**.—Narrow, furrowlike peristome generally beginning close to the anterior end and running back, ventrally, to the mouth, which usually lies between the middle and the posterior end of the body. The adoral zone is usually straight and is placed along the left side of the peristome. Typical genus, *Nyctotherus* Leidy, 1849.

Family **Bursariidae**.—Body usually short and pouchlike, but it may be elongate. The peristome is in the form of a broad and deep triangular area, the apex of which is at the mouth. The adoral zone lies on the left edge of the peristome and may extend over to the right anterior edge. Typical genera: *Bursaria* O. F. Müller, 1773; *Balantidium* Stein, 1867.

² Sharp, Robert G., *Diplodinium ecaudatum* with an account of its neuromotor apparatus, *Univ. Calif. Pub. Zool.* (1914), 13, No. 4, 43.

³ Stein, F., Ueber mehrere neue im Pansen del Wiederkäuer lebende Infusionsthier, *Abh. d. Kais. Böhm. Ges. Wiss.* (1858), 10, 69; cited by Sharp.

Subphylum **INFUSORIA**—Continued.

Class **Ciliata**—Continued.

Order **Heterotrichida**—Continued.

Suborder **Polytrichina**—Continued.

Family **Stentoridæ**.—The relatively short peristome is limited to the anterior end of the body, its plane lying at approximately right angles to the long axis of the body. There is an adoral zone of cilia, which may completely encircle the edge of the peristome or may end at the right-hand edge. The surface of the peristome is ciliated and shows spiral striations. The body is often highly contractile. There are no undulating membranes. Typical genus, *Stentor* Oken, 1815.

Suborder **Oligotrichina**.—The ciliation is reduced and limited to certain localized areas.

Family **Lieberkühnidæ**.—Includes forms that were first thought to be young stentors. Little is known of them.

Family **Halteridæ**.—The ciliation is scant and scattered over the ventral and dorsal surfaces. The peristome is not provided with cilia. Typical genus, *Halteria* Dujardin, 1841.

Family **Tintinnidæ**.—The body is contained in a cup or theca, to which it is attached by a stalk. There is a ring of paroral cilia inside of the adoral zone of membranelles. Typical genus, *Tintinnopsis* Stein, 1867.

Family **Ophryoscolecidæ**.—Distinct spinelike processes appear at the posterior end, and there is a well-defined anal tube that leads to the anal pore. The peristome is deep and funnel-like. The cuticle is thick. See Family **Isotrichidæ**. Typical genus, *Ophryoscolex* Stein, 1859.

Order **Hypotrichida**.—In this order the cilia are limited to the ventral surface of a body that shows marked dorsoventral flattening. The cilia are frequently fused to form brushlike cirri, which are used as creeping organs and which may have a tactile function. There is an adoral zone of membranelles. Bristles are frequently present on the dorsal surface. The pharynx may be slightly developed or altogether absent.

Family **Peritromidæ**.—There are no cirri, the cilia on the ventral surface being uniform in size and arrangement. The peristome is but slightly differentiated from the rest of the frontal area. Typical genus, *Peritromus* Stein, 1862.

Family **Oxytrichidæ**.—The structure of some members of this family is often quite complex. Some species, however, are more primitive, somewhat resembling those in the family **Peritromidæ**, the ciliation on the ventral surface being uniform. Even here, some of the anterior and some of the posterior cilia are fused to form cirri that are spoken of as *frontal* and *anal* cirri, respectively. In the greater number of species all of the cilia are thus modified. There are strong marginal cirri that occur in perfect rows, while the ventral cirri are less regularly arranged. There is an undulating membrane on the right side of the peristome, which is in addition to the adoral zone of membranelles, and in some cases, a row of cilia between this membrane and the adoral zone. These are the paroral cilia, which form the paroral zone.

Subphylum INFUSORIA—Continued.

Class Ciliata—Continued.

Order Hypotrichida—Continued.

Family Oxytrichidae—Continued.

Typical genera: *Oxytricha* Ehrenberg, 1830; *Stylonychia* Stein, 1859.

Family Euplotidae.—Cilia and frontal, marginal, and ventral cirri greatly reduced. Anal cirri always present. The macronucleus is band-shaped. Typical genus, *Euplotes* Stein, 1859.

Order Peritrichida.—The body is cylindrical or cup-shaped. The cilia are reduced, generally, to those entering into the formation of the adoral zone. Secondary rings of cilia may be present. Includes some beautiful colonial forms.

Family Spirochonidae.—The peristome is drawn out to a peculiar funnellike process, which may be either simple or rolled. Reproduction is by a process of budding. Parasitic forms. Typical genus, *Spirochona* Stein, 1851.

Family Lichnophoridae.—There is a secondary circlet of cilia around the opposite end in addition to the adoral zone. The adoral zone is a left-wound spiral. The family contains a single genus, *Lichnophora* Claparède, 1867. It is parasitic on marine arthropods.

Family Vorticellidae.—Peritrichous ciliates, attached or unattached. Viewed from above the adoral zone forms a right-wound spiral. The under end may show a secondary circlet of cilia, which may be either temporarily or permanently present.

Subfamily Urceolarinae.—The secondary circlet of cilia is permanent. It incloses an adhesive disk. There is no peristome fold. Typical genus, *Trichodina* Stein, 1854.

Subfamily Vorticellidinae.—No permanent secondary circlet of cilia. A sphincterlike, contractile, peristome fold incloses the peristome. Typical genera: *Vorticella* Ehrenberg, 1838; *Zoothamnium* Stein, 1854.

Class Suctoria (Acinetaria).—There are no cilia during the adult stages, but they are present during the young or "embryonic" stage. The cilia may be retained in a few cases. Tentacles, variously modified, are present. Some of these are suctorial, some adapted for piercing.

Family Hypocomidae.—Permanently ciliated ventral surface and one suctorial tentacle. They are unattached. Division transverse. But one genus, *Hypocoma* Gruber, 1884.

Family Urnulidae.—Small attached forms giving rise to holotrichous swarm spores. May or may not be provided with a cup or theca. There are one, two, or rarely more simple tentacles. Typical genus, *Urnula* Claparède and Lachmann, 1858.

Family Metacinetidae.—The animal lives in a theca or cup. The base of this cup is drawn out to form a long stalk. The walls are perforated for the exit of the tentacles. But one genus, *Metacineteta* Bütschli, 1888.

Family Podophryidae.—The general shape is globular. There may or may not be a stalk. There are numerous tentacles distributed about the entire surface, or they may be limited to the apical region.

Subphylum INFUSORIA—Continued.

Class Suctorina—Continued.

Family Podophryidæ—Continued.

The tentacles are prehensile and may be knobbed or pointed. Typical genus, *Ephelota* Str. Wright, 1858.

Family Acinetidæ.—Reproduction is typically by endogenous budding. This may be simple or multiple. Swarm spores are formed, which may be peritrichous, holotrichous, or hypotrichous. The individuals are naked and stalked or thecate and either stalked or unstalked. There are numerous tentacles, usually similar and knobbed. Typical genus, *Acineta* Ehrenberg, 1838.

Family Dendrosomidæ.—Suctorina that may be either simple or branched. There are no stalks or theca. The numerous tentacles are similar and grouped in tufts and are knobbed. Peritrichous swarm spores are produced. Reproduction is by endogenous budding. Typical genus, *Dendrosoma* Ehrenberg, 1838.

Family Dendrocometidæ.—Sessile forms, which rest upon the entire basal surface or upon a raised portion which forms a stalk. The tentacles are short and knobbed and numerous and may be distributed over the entire apical surface or be localized upon branched arms. Reproduction by endogenous spore formation, the swarmers being peritrichous. Typical genus, *Dendrocometes* Stein, 1867.

Family Ophryodendridæ.—There are numerous long, sometimes knobbed tentacles, supported upon proboscislike processes of the apical side. Reproduction by endogenous budding with the formation of peritrichous swarm spores. Stalked or sessile. Typical genus, *Ophryodendron* Claparède and Lachmann, 1858.

SOME STANDARD WORKS ON THE PROTOZOA

The following does not, by any manner of means, exhaust the list of standard works on the Protozoa. Practically all of them include an exhaustive and up-to-date bibliography, and they are books that are more or less accessible to the average reader.

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TWO NEW SPECIES OF SCIARA FROM THE PHILIPPINES

By F. W. PETTEY

(Cornell University, Ithaca, New York)

ONE PLATE

Through the courtesy of Dr. E. P. Felt, specimens of *Sciara*, collected in the Philippine Islands under the direction of Professor Charles S. Banks, of the department of entomology, College of Agriculture, at Los Baños, by Mr. L. B. Uichanco, have been sent to the Department of Entomology, Cornell University, for identification. The species are apparently undescribed.

Sciara bispinosa sp. nov. Plate I, figs. 2 and 4.

Male.—Length, 1 millimeter. Head black, shiny; antennæ fuscous, over two-thirds the length of the body. Thorax black, shiny, pleura fuscous. Abdomen black; hypopygium fuscous, with no small setiferous median ventral lobe at base; clasper (Plate I, fig. 2) with two stout subapical spines and a group of shorter more slender apical spines. Legs dull brown, tarsi darker; length of hind tibia and tarsus about equal. Wings (Plate I, fig. 4) hyaline; veins of medium strength; media and cubitus without setæ; base of Rs noticeably distad of the mid point between the tip of R, and the humeral cross vein; R, ends noticeably proximad of the forking of media; petiole of cubitus slightly longer than the base of media; costa extends over two-thirds of the distance between the tips of Rs and M₁; Rs ends distad of 0.85 of the wing length and noticeably proximad of the tip of M₂. Halteres fuscous.

LUZON, Laguna Province, Los Baños, March 16, 1917, College of Agriculture accession No. 18153 (*L. B. Uichanco*). Described from one male. Type in the Cornell University collection.

Sciara uichancoi sp. nov. Plate I, figs. 1 and 3.

Male.—Length, 2.3 millimeters. Head black, shiny; antennæ and palpi fuscous, anterior end of scape luteous, antennæ about as long as head and thorax. Thorax black, shiny; angle of humerus luteous; pleura dark fuscous. Abdomen black, venter fuscous, hairs whitish; hypopygium fuscous with no small median setiferous lobe, clasper with about six stout spines, two of which are stouter than the rest (Plate I, fig. 1). Coxæ and femora

luteous; trochanters black; tibiae brownish; tarsi fuscous; hind tibia a little longer than tarsus. Wings (Plate I, fig. 3) smoky brown; R_1 and R_s strongly marked, petiole and base of fork of media extremely faint, petiole of cubitus a little over one-half as long as what appears to be the base of media; R_1 ends about opposite the forking of M ; the base of R_s about midway between the humeral cross vein and the tip of R_1 ; costa extends over half the distance between the tip of R_s and M_1 ; R_s ends considerably distad of 0.85 of the wing length and considerably distad of the termination of M_2 . Knobs of halteres black, pedicels luteous.

Female.—Length, 2.8 millimeters. Colored like the male. The faint media is a little more distinct than in the male specimens.

LUZON, Laguna, Mount Maquiling, August 28, 1917, College of Agriculture accession No. 18176 (*L. B. Uichanco*). Described from two males and one female. Type and allotype in the Cornell University collection. Autotype in the College of Agriculture collection, Los Baños, P. I.

ILLUSTRATION

PLATE I

- FIG. 1. *Sciara uichancoi* sp. nov., male clasper, $\times 300$.
2. *Sciara bispinosa* sp. nov., male clasper, $\times 300$.
3. *Sciara uichancoi* sp. nov., wing of male (photomicrograph).
4. *Sciara bispinosa* sp. nov., wing of male (photomicrograph).

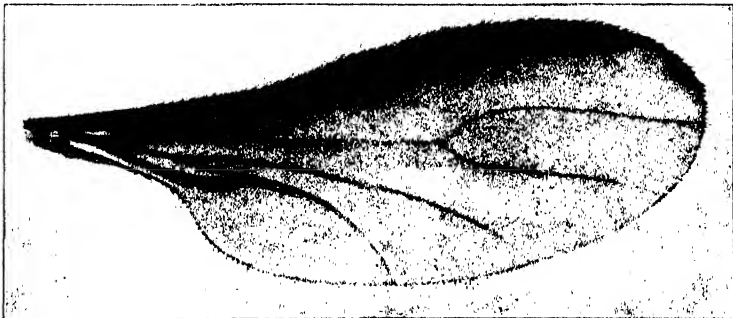
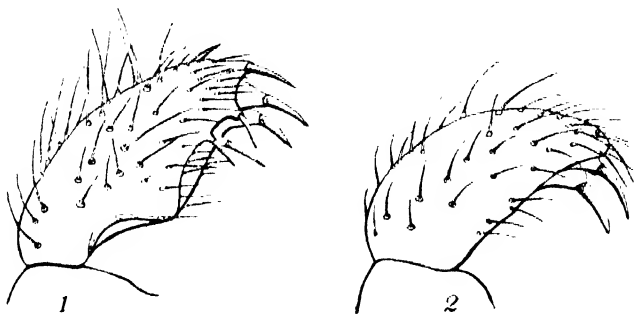


PLATE I.

Figs. 1 and 3. *Sciara ulchanool* sp. nov. 2 and 4. *Sciara bispinosa* sp. nov.

NOTES ON NEMATODE PARASITES OF PHILIPPINE BIRDS

TETRAMERES FISSISPINA (DIESING, 1860) IN PHILIPPINE CHICKENS

By LAWRENCE D. WHARTON

(Assistant Professor of Zoölogy, University of the Philippines)

In October, 1917, Professor Charles S. Banks brought me a number of nematode worms, which had been collected from the proventriculus of a chicken at the College of Agriculture in Los Baños. On examination these worms were found to belong to the genus *Tetrameres* Creplin, 1846. This genus contains thirteen species of worms, all of which have been found in the digestive tract of birds. However, only one species, *Tetrameres fissispina* (Diesing, 1860), has been reported as a parasite of chickens. This form was reported from this host in Brazil in 1914 by Travassos¹ and in Guam in 1915 by Ransom.²

Further study of the specimens furnished by Professor Banks and of others, which I have obtained here in Manila, has led to the conclusion that the Philippine species is identical with that reported by Travassos and by Ransom.

Tetrameres fissispina (Diesing, 1860).

Tropidocerca fissispina Diesing, 1860.

Acanthophorus tenuis v. Linstow, 1876.

Acanthophorus horridus v. Linstow, 1876.

Tropidocerca inflata Zuern, 1882, nec Diesing, 1860.

Tropisorus fissispinus Neuman, 1888.

Tropisurus fissispinus Railliet, 1895.

All the species of this genus are remarkable for their great sexual dimorphism, the males being long, slender white worms and the females subglobular and red or brown.

Female.—Length, 3 to 6 millimeters; diameter, 2 to 3.5 millimeters. Body subglobular, blood red, with slender conical cephalic and caudal projections. The body is transversely striated and bears four longitudinal depressions, which correspond to the median and lateral lines. The two extremities are

¹ Travassos, Paul, Sobre as especies brasileiras do genero *Tetrameres* Creplin, 1846, *Memorias do Instituto Oswaldo Cruz* (1914), 6, 150-162.

² Ransom, B. H., Proceedings of the Helminthological Society of Washington, *Journ. Parasit.* (1915), 2, 93.

more or less retractile and movable from side to side, the anterior or cephalic projection measuring 1.2 millimeters in length and the posterior 0.5 to 0.9 millimeter.

The mouth is at the end of the cephalic projection and is surrounded by three lips, each of which bears a terminal papilla. It opens into a rounded buccal cavity about 20 μ in diameter. The œsophagus extends throughout the length of the projection and opens into a large sacklike intestine, which continues through the body and into the caudal projection, where it opens about 0.2 millimeter from the posterior end. The intestine generally contains a mass of black coloring matter, so that it can be easily followed through the body. At the junction of the œsophagus with the intestine is a mass of unicellular glands.

The genital organs occupy the greater part of the body and consist of a mass of much coiled and twisted tubes. The uteri are double and unite to form a long vagina, which opens ventrally at the junction of the caudal extremity with the body. Just anterior to the opening there is a round sacklike diverticulum of the vagina. The uterus and the vagina with its diverticulum are always filled with eggs in different stages of segmentation. The eggs are oval and thin-shelled and measure 48 to 56 μ in length by 26 to 30 μ in breadth. They contain a coiled embryo when they are ready to leave the body of the parent worm.

Male.—Length, 4 to 5 millimeters; diameter, 0.11 to 0.2 millimeter. The body is threadlike and white and is transversely striated. Along each lateral and median line is a single row of small spines, which point backward. These spines begin just back of the buccal cavity and extend beyond the level of the anus. In the anterior and posterior regions they are about 20 μ apart, but in the middle of the body they are separated by as much as 115 μ .

In the male the alimentary canal is distinctly different from that of the female. It is divided into a short buccal capsule, an œsophagus composed of a short, slender, muscular portion and a long, wide, posterior portion that opens into a tubelike intestine; the latter does not show any of the black color that is so prominent in the female intestine. The anus opens about 0.25 millimeter from the tip of the tail.

There are two unequal spicules, a short sharp-pointed one 115 μ long and 4 μ in thickness and a long one measuring 320 μ in length by 15 μ in thickness and with a rounded end.

Habitat.—The female worms lie embedded in the gastric glands of the proventriculus. They can be seen from the outside as small, round red spots in the walls. The males lie either free

in the lumen of the proventriculus or with one end buried in the duct of a gland. On account of their small size they are difficult to find and also seem to be much less numerous than the females. It is probable that they die after fertilization is accomplished, as I have never found any males in chickens in which the females appeared to be old.

Host.—*Tetrameres fissispina* has been reported from the mud hen (*Fulica atra*), the duck (*Anas boschas*), and the chicken (*Gallus domesticus*). Since receiving the specimens from Professor Banks, I have examined 100 chickens here in Manila and have found this parasite in 76 of them. It is by far the commonest parasite that I found. I have not had the opportunity to make examinations of ducks to see if it is also found in them.

Pathogenicity.—None of the chickens examined by me have shown any gross pathological conditions that could be traced to the presence of the worms in the walls of the alimentary canal. However, I believe that the presence of these worms, particularly in young chickens, must undoubtedly interfere with the secretion of the glands and result in a general lowering of the vitality of the infested individuals.

A FEW RARE BIRDS FROM LUZON AND MINDORO

By JOHN T. ZIMMER
(Port Moresby, Papua)

In the collection of birds secured by me in the Philippines during 1913 to 1916, inclusive, are various specimens that through the rarity of the species concerned, unusual distribution, or peculiar plumage represent captures of special interest. One form of thickhead (Laniidæ) is described as new. Numbers in tables and in parentheses after discussions of species refer to my collection, which is at Lincoln, Nebraska, U. S. A.

Acknowledgments are made to Mr. R. C. McGregor, of the Philippine Bureau of Science at Manila, for the freedom of the collection at that institution and for other generous assistance.

Turnix whiteheadi Grant.

On the night of October 25, 1914, I was crossing a stretch of cogon-covered hills near Bondog Point in the southern part of Tayabas Province, Luzon. I had a small acetylene lamp fastened to my hat and was on the lookout for whatever might appear in the ray of light before me, when suddenly a covey of button quails got up from underfoot and, as usual, scattered in all directions. One of the birds, blinded by the glare of the light, flew directly into my hands, and I captured it before it could escape. Upon examination it proved to be a female *Turnix whiteheadi*. The habits and habitat of this species appear to be little known, since the only specimens heretofore on record were trapped by Filipinos and were sold in the Manila markets. (No. 1117.)

Leucotreron marcheii (Oustalet).

It has been supposed that this handsome pigeon was confined to the Lepanto and Bontoc mountains of northern Luzon, but it proves to occur in the southern part of Luzon also. On December 31, 1915, I secured an adult female from a small flock, at about 1,500 meters' elevation (5,000 feet) on Mount Banahao, Laguna Province. This specimen is identical with one from the north. (No. 1833.)

Sterna sinensis Gmelin.

This tern is by no means common on Luzon. My only specimen is a female, which I shot out of a small flock wheeling over the Las Piñas salt beds, near Manila, on September 12, 1915. (No. 1278.)

Ægialitis alexandrina (Linnæus).

At Bondog Point, Tayabas Province, on October 20, 1914, I collected a female Kentish plover, which is, so far as I know, the first one taken on Luzon. (No. 1115.)

Totanus eurhinus (Oberholser).

I have a female redshank, which I took on the Las Piñas salt beds, near Manila, on August 30, 1914. It was quite alone when taken. This is the first Luzon record for this bird. (No. 1052.)

Ardea cinerea Linnæus.

On October 19, 1914, I secured a female of this interesting heron at Bondog Point, Tayabas Province. The only other published records for Luzon are those by McGregor.¹ The species is rare throughout the Archipelago. (No. 1112.)

Ceyx melanura Kaup.

I found this little gem of the kingfisher family to be rather rare. My only specimen is a male, taken on October 4, 1914, at a few hundred feet elevation on Mount Maquiling, Laguna Province, Luzon. (No. 1086.)

Hemiprocne major (Hartert).

In the Additions and Corrections to his Manual of Philippine Birds, McGregor places the whiskered swifts from Mindanao, Samar, Sibutu, and Sulu in the species *comata* (Temminck). While not questioning the occurrence of *comata* on Mindanao, I am of the opinion that not all of the Mindanao birds belong to that form. This conclusion is reached on the basis of a pair of these swifts that I obtained on Mount Larugan, Bukidnon Province, which are larger than some of my Luzon specimens. The following comparison of wing measurements will illustrate:

TABLE I.—Measurements of *Hemiprocne* from Mindanao and from Luzon.

No.	Sex.	Locality.	Date.	Wing.
				mm.
1242	♀	Bukidnon Province, Mindanao	May 19, 1915	137
1241	♂	do	do	135
1268	♀	Antipolo, Rizal Province, Luzon	Aug. 15, 1915	132
1310	♀	Mount Banahao, Laguna Province, Luzon	Nov. 22, 1915	136
1298	♀	Mount Maquiling, Laguna Province, Luzon	Oct. 10, 1915	138
1297	♂	do	do	133

¹ Manual of Philippine Birds. Bureau of Science, Manila (1909), 163, and *This Journal*, Sec. D (1916), 11, 273.

***Hierococcyx fugax* (Horsfield).**

I have four specimens of this interesting cuckoo taken on Luzon. All but one are immature birds. Their habitat seemed to embrace both the lower mountain slopes and the bamboo thickets of the lowland.

TABLE II.—*Specimens of Hierococcyx fugax.*

No.	Sex.	Locality.	Date.
1169	♂ ad.	Mount Mariveles, Bataan Province, Luzon.	January 1, 1915.
1206	♂ imm.	do.	April 2, 1915.
859	♀ imm.	Manila, Luzon.	January 18, 1914.
1087	♀ imm.	Mount Maquiling, Laguna Province, Luzon.	October 9, 1915.

***Cuculus canorus* Linnæus.**

Philippine records for any of the species of the present genus are not numerous, and Luzon records are quite lacking. A fine male, which I collected on Mount Mariveles, Bataan Province, on April 3, 1915, thus represents the first Luzon record of the present species. My bird was taken along Lamao River at only a few hundred feet elevation. (No 1207.)

***Centropus unirufus* (Cabanis and Heine).**

On November 7, 1913, while among the mountains of Rizal Province, Luzon, I shot a fine male rufous cuckoo, the first and last one I ever encountered. (No. 783.)

***Pitta atricapilla* Lesson.**

The black-headed pitta is not rare in the Philippines, and I have specimens from several of the Islands. One female, which I collected at Bondog Point, Tayabas Province, Luzon, varies from the ordinary in the possession of more or less distinct, though irregular streaking; this is in the form of obovate or triangular marks along the shafts of certain feathers. On the back and scapulars it is black, conspicuous against the shining green of those parts, but on the breast and flanks it is a faint drab, visible only in certain lights. A male from Balabac has a trace of the dorsal streaking, but only two feathers are thus marked. The Luzon bird is dated October 25, 1914. (No. 1118.)

***Hirundo gutturalis* Scopoli.**

A male and a female *Hirundo*, taken at Las Piñas, Rizal Province, Luzon, on September 19, 1915, are so near to *H. rustica* Linnæus that it is a question whether or not they should be

referred to that species rather than to the present one. The black pectoral band is quite complete; and the under parts are decidedly rufous, much more so than in several other specimens taken from the same flock as these, and still others from different localities. However, since there are no definite records of *H. rustica* from Luzon and since the two forms apparently intergrade, I will leave this note as it stands. (No. 1289, male; No. 1287, female.)

Hirundo striolata (Boie).

I found a large colony of mosque swallows nesting under an old bridge at Tiaong, Tayabas Province, Luzon, where I secured four specimens on August 11, 1915.

Cyornis herioti Ramsay.

This rare flycatcher was described from northern Luzon, where it was supposed to be restricted. I was accordingly agreeably surprised on March 29, 1914, to find one of them on Mount Maquiling, Laguna Province, at about 305 meters' elevation (1,000 feet). It was alone when taken. (No. 955.)

Rhipidura hutchinsoni Mearns.

I have a single female of this fantail, which I took in Bukidnon Province, Mindanao, near Sumilao. This species is confined to Mindanao and has been taken previously only on Mount Malindang at from 1,200 to 2,700 meters (4,000 to 9,000 feet). My specimen was taken at not more than 900 meters (3,000 feet). The Bukidnon natives called this bird *ka-tú-pai*, although they applied the same name to *Xeocephus cinnamomeus*. Mearns says, "chest * * * deep cinnamon," but this part in my specimen is nearer Ridgway's apricot buff.

Culicicapa helianthea (Wallace).

This little flycatcher is not rare in certain localities, but is not distributed throughout its range. I found it only on Mount Banahao, Laguna Province, Luzon, and at Sumilao, Bukidnon Province, Mindanao.

TABLE III.—*Specimens of Culicicapa helianthea.*

No.	Sex.	Locality.	Date.
1322	♂	Mount Banahao, Laguna Province, Luzon.....	December 30, 1915.
1323	♂	do.....	Do.
1306	♂	do.....	November 21, 1915.
1569	♀	do.....	December 7, 1915.
1252	♂	Sumilao, Bukidnon Province, Mindanao.....	May 23, 1915.
1251	♀	do.....	Do.

***Cryptolopha olivacea* (Moseley).**

I have a number of specimens of this species from Laguna Province, Luzon. Most of them were taken from mixed flocks of *Acanthopneuste*, *Pardaliparus*, and *Zosterornis*, rarely alone.

TABLE IV.—*Specimens of Cryptolopha olivacea.*

No.	Sex.	Locality.	Date.
1299	♂	Mount Maquiling, Laguna Province, Luzon	October 31, 1915.
1198	♂	do	March 21, 1915.
1275	♂	do	September 5, 1915.
1016	♂	do	June 7, 1914.
1204	♀	do	March 28, 1915.
1213	♀	do	April 11, 1915.
1324	♂	Mount Banahao, Laguna Province, Luzon	December 30, 1915.

***Cryptolopha nigrorum* Moseley.**

My only specimen of this bird was taken at Baguio, Mountain Province, Luzon, on May 10, 1914. It is a male. (No. 996.)

***Cryptolopha mindanensis* Hartert.**

I have a male of this little warbler, taken at Sumilao, Bukidnon Province, Mindanao, on May 14, 1915. (No. 1225.)

***Eumyias nigrimentalis* (Grant).**

I hunted long for this flycatcher in south-central Luzon, but did not find it until I began collecting on Mount Banahao. There I succeeded in getting three specimens, all males, on as many different occasions. (No. 1305, November 21, 1915; No. 1323, December 30, 1915; No. 1557, December 7, 1916.)

***Edolisoma caerulescens* (Blyth).**

There appear to be numerous records for this bird from Luzon, but I only saw it on October 12, 1914, when I secured a female at Bondog Point, Tayabas Province. (No. 1095.)

***Iole everetti* (Tweeddale).**

One specimen, a female, is in my collection, taken at Mailag, Bukidnon Province, Mindanao, on May 19, 1915. It was in the forest at the foot of a range of hills. (No. 1247.)

***Zosterornis whiteheadi* Grant.**

Whitehead's tree babbler is common at Baguio, Benguet Sub-province, Luzon, and strangely enough occurs on Mount Banahao, Laguna Province. The Mount Banahao specimens are somewhat distinguishable from the average northern bird by

their brighter coloration above and below, but the difference is hardly worthy of recognition by name.

An interesting question is raised by the occurrence on Mount Banahao of several avian species that are found there but not on other mountains near to it. The present species furnishes one example, *Leucotreron marcheii* another. These birds were taken at low elevations on Mount Banahao, from 600 to 900 meters (2,000 to 3,000 feet), heights which are found on Mount Maquiling, for instance, where these birds do not occur. The explanation may be that some of the higher mountain forms, such as the present, are accustomed to descend to lower levels but do not inhabit isolated peaks like Mount Maquiling, where the greater altitudes are not available for retirement when desirable. Undoubtedly a vertical migration of sorts takes place on the mountains in the Philippines, which brings numbers of birds to lower altitudes during the rainy seasons and sends them upward when the lower slopes of the hills feel the effect of the dry weather. To lend strength to this theory, it may be stated that the rains were prevalent about Mount Banahao when these observations were made in December.

I have seen also on Mount Banahao, at over 1,800 meters' elevation (6,000 feet), a black thrush, *Planesticus* sp.?, and a *Phyllergates* near *philippinus*, neither of which was secured. Owing to the height at which they were seen, they hardly enter the above discussion. My specimens of *Z. whiteheadi* are as follows:

TABLE V.—*Specimens of Zosterornis whiteheadi.*

No.	Sex.	Locality.	Date.
994	♂	Baguio, Benguet Subprovince, Luzon	May 10, 1914.
1000	♂	do	May 11, 1914.
1001	♀	do	Do.
1321	♂	Mount Banahao, Laguna Province, Luzon	December 30, 1915.
1325	♂	do	Do.
1332	♂	do	December 31, 1915.
1330	♀	do	Do.

Zosterornis affinis McGregor.

This interesting species has been known heretofore from a single male collected in 1904 on Mount Mariveles, Bataan Province, Luzon, by A. Celestino. I have since collected a number of specimens on Mount Maquiling, Laguna Province, including the first known female of the species.

The female may be described as indistinguishable from the

male type of the species, with which I have carefully compared it.

The birds were usually associated with *Pardaliparus elegans* and *Acanthopneuste borealis*, although my first specimen was a solitary individual. The habitat was the area of lower mountain slopes of the forest up to 610 meters (2,000 feet).

TABLE VI.—*Specimens of Zosterornis affinis.*

No.	Sex.	Locality.	Date.
956	♂	Mount Maquiling, Laguna Province, Luzon	March 29, 1914.
1023	♂	do	June 14, 1914.
1201	♂	do	March 28, 1915.
* 1195	♀	do	March 21, 1915.
1212	♀	do	April 11, 1915.

* Type of the female.

Brachypteryx poligyna Grant.

I have a male of Grant's shortwing, which I took at 2,012 meters' elevation (6,600 feet) on Mount Banahao, Laguna Province, on January 1, 1916. (No. 1334.)

Pratincola caprata (Linnaeus).

This species does not seem to have been recorded from Mindanao, but it is certainly abundant over the Bukidnon highlands. I was under the impression that the species was known from that island, or I should have taken specimens in May, 1915, when I was in the region. I had left the locality when I discovered my mistake.

Orthotomus chloronotus Grant.

Most of the tailorbirds in the region about Manila are *Orthotomus derbianus*, but on the lower slopes of some of the mountains there are a few of the present form. I have a male from Antipolo, Rizal Province, and another from Lamao, Bataan Province. The habits of the two species are alike.

TABLE VII.—*Specimens of Orthotomus chloronotus.*

No.	Sex.	Locality.	Date.
896	♂	Antipolo, Rizal Province, Luzon	February 1, 1914.
1163	♂	Lamao, Bataan Province, Luzon	December 31, 1914.

Acanthopneuste xanthodryas (Swinhoe).

I find among my series of *Acanthopneuste* several specimens that are referable to *A. xanthodryas* rather than to *A. borealis*,

by reason of the longer first primary and general tone of coloration. I believe that *A. xanthodryas* is commoner than is supposed, but this is a difficult fact to prove, since the two forms are so much alike and both keep to the upper foliage of the forest.

TABLE VIII.—*Specimens of Acanthopneuste xanthodryas.*

No.	Sex.	Locality.	Date.
849	♂	Manila, Luzon	January 4, 1914.
980	♂	Bautista, Pangasinan Province, Luzon	April 8, 1914.
1111	♂	Bondog Point, Tayabas Province, Luzon	October 19, 1914.
1081	♀	Las Pifias, Rizal Province, Luzon	September 27, 1914.
1233	♀	Mailag, Bukidnon Province, Mindanao	May 18, 1915.

Horornis seebohmi (Grant).

I have two examples of this little bush warbler from Baguio, Mountain Province, Luzon, which were collected on May 12, 1914. The first one gave me considerable trouble to collect. I could hear it singing its "o-o-o-o I-see-you-a-seet!" only a few yards away in the low bush and grasses and could likewise hear its sharp "chip" as it moved about near the ground, but it was fully fifteen minutes that I strained my eyes before I finally saw the skulking songster and secured it. The second one was obtained only a few minutes afterward. (No. 1005, female; No. 1006, male.)

Hyloterpe orissalis sp. nov.

Characters of the species.—Similar to *Hyloterpe albiventris* Grant, but throat paler and crissum decidedly yellower.

Type.—No. 1336, male, adult, collection of John T. Zimmer; Mount Banahao, 914 meters (3,000 feet), Laguna Province, Luzon, P. I., January 3, 1916.

Description.—Above dark olive green, scarcely brighter on the rump and upper tail coverts; remiges and rectrices blackish brown, broadly edged with bright olivaceous; top of head browner than the back; cheeks and ear coverts brownish olive like the crown; chin and throat grayish white, the feathers with blackish shafts and dusky streaks; breast grayish olive, feathers with median dusky streaks; abdomen and flanks buffy white, indistinctly streaked with dusky; crissum lemon yellow, much brighter than in *H. albiventris*, but not so bright as in *H. fallax* McGregor; axillars and wing lining white with a yellowish tinge. Bill black; feet dull gray; iris brown. Length (of skin), 152 millimeters; wing, 80.5; tail, 65; tarsus, 21; culmen from base, 15.5; bill from nostril, 10.

A male paratype was taken at the same locality on December 30, 1915. (No. 1326.)

Rhabdornis minor Grant.

I have a female creeper of this species, which I took at Sumilao, Bukidnon Province, Mindanao, on May 14, 1915. It differs slightly from the usual plumage of this form in that the feathers of the breast and sides of lower throat are bordered with dull grayish brown and the mantle feathers are not so conspicuously white-shafted. (No. 1224.)

Zosterops basilanica Steere.

I shot a female *Zosterops basilanica* in the Mindanao highlands on May 18, 1915. It was taken from the trees bordering a river at Mailag, Bukidnon Province. (No. 1234.)

Zosterops aureiloris Grant.

I have four males of this beautiful little silvereye taken on the slopes of Mount Maquiling and Mount Mariveles at approximately 460 meters' elevation (1,500 feet). Each bird taken was secured from a group of three or four of the species. They are very active and energetic little creatures.

TABLE IX.—Specimens of *Zosterops aureiloris*.

No.	Sex.	Locality.	Date.
960	♂	Mount Maquiling, Laguna Province, Luzon	March 29, 1914.
1025	♂	do.....	June 14, 1914.
1154	♂	do.....	December 20, 1914.
1159	♂	Mount Mariveles, Bataan Province, Luzon.....	December 31, 1914.

Dicæum xanthopygium Tweeddale.

This flowerpecker was not common, but I occasionally saw it in the mountains of south-central Luzon, usually in company with *D. papuense* Gmelin. I have two specimens, both males. They were collected on Mount Maquiling, Laguna Province, Luzon, on February 22 and June 1, 1914, respectively. (Nos. 913 and 925.)

Dicæum obscurum Grant.

I have collected *Dicæum obscurum* on Mount Maquiling, Luzon, at about 600 meters' elevation (2,000 feet) and have two males in my collection taken there on February 15 and June 14, 1914, respectively. (Nos. 908 and 1027.)

Dicæum nigrilore Hartert.

I secured a female of the present species at Sumilao, Bukid-

non, Mindanao, on May 14, 1915. It was among the trees bordering a deep cañon. (No. 1223.)

Prionochilus inexpectatus Hartert.

This flowerpecker was not very common in my experience. I have two females from Luzon and one male from Mindoro.

TABLE X.—*Specimens of Prionochilus inexpectatus.*

No.	Sex.	Locality.	Date.
1083	♀	Mount Maquiling, Laguna Province, Luzon	June 28, 1914.
1186	♀	do.....	March 7, 1915.
1532	♂	San Jose, Mindoro	April 17, 1916.

Eudrepanis jefferyi Grant.

A female of this species that I have differs from the specimens in the Bureau of Science collection in being decidedly lighter above and below and in possessing a more or less distinct white loreal spot. It was taken on Mount Banahao, Laguna, Luzon, on January 3, 1916, at about 914 meters' elevation (3,000 feet). (No. 1235.)

Cinnyris flagrans (Oustalet).

This beautiful little sunbird appears to be well distributed over south-central Luzon, but is not common anywhere. All the individuals I have seen were in mixed flocks of related forms.

TABLE XI.—*Specimens of Cinnyris flagrans.*

No.	Sex.	Locality.	Date.
1127	♂	Mount Maquiling, Laguna Province, Luzon	November 15, 1914.
1187	♂	Longos, Laguna Province, Luzon	November 28, 1914.
1313	♂	Silang, Cavite Province, Luzon	December 5, 1915.
1329	♂	Mount Banahao, Laguna Province, Luzon	December 30, 1915.

Oriolus albiloris Grant.

On April 4, 1915, I secured a fine female of this rare, forest-inhabiting oriole at Mariveles, Bataan Province, Luzon. It was on the lower slopes of the mountain. (No. 1208.)

Sturnia philippensis (Forster).

The only Luzon specimen of this starling that I have was taken on October 11, 1914, at Bondog Point, Tayabas Province, Luzon. (No. 1091.)

REPTILES OF SULU ARCHIPELAGO

By EDWARD H. TAYLOR

(From the Section of Ichthyology, Biological Laboratory, Bureau of Science, Manila)

THREE PLATES AND ELEVEN TEXT FIGURES

While on a fisheries exploration in Sulu Archipelago small collections of reptiles were made on several of the islands visited. As zoölogical collecting was only of secondary consideration on the trip, the attention that such collecting merited was not given to it. However, some specimens taken are new and are of much interest and importance. The known limits of distribution of several Philippine species were extended and many rare species and three species heretofore unknown to the Philippine fauna were found. The following species are described as new:

- | | |
|--|--|
| 1. <i>Luperosaurus joloensis</i> . | 4. <i>Sphenomorphus biparietalis</i> . |
| 2. <i>Hemiphyllodactylus insularis</i> . | 5. <i>Brachymeles suluensis</i> . |
| 3. <i>Lepidodactylus divergens</i> . | 6. <i>Brachymeles vermis</i> . |

The following species are here recorded for the first time from the Philippine Islands:

- | | |
|-----------------------------------|---|
| 1. <i>Mabuya rudis</i> Boulenger. | 3. <i>Lepidodactylus woodfordi</i> Boulenger. |
| 2. <i>Riopa bowringi</i> Günther. | |

Of the forty-seven species here listed, four are known only from Mindanao and northern Philippine Islands; forty-three are found in the Sulu Archipelago and in Basilan. Of this number nineteen are common to Mindanao, Sulu, and Borneo; eight species are common to Mindanao and Sulu only; six are common to Borneo and Sulu, but are not known to occur in Mindanao; seven species are known only from Sulu; two are common to Sulu and other northern Philippine Islands, but as yet are not known from Mindanao; and one is common to Sulu and New Guinea. This tells but little regarding actual faunal relationships, as Mindanao, Borneo, and Sulu Archipelago have been but little explored zoölogically. Unfortunately very few specimens were taken or observed on the Sibutu Group of islands, which is the group nearest the Borneo coast. The collection made on the Borneo coast also was a very small one, reptiles, especially snakes, being rather rare. A planter living at Tunku Point told me he had seen only a single snake in two years' residence on his plantation.

LIZARDS

Gymnodactylus annulatus Taylor. Text figs. 1 and 2.

This species was found to be especially common on nearly all the islands visited. Specimens were found under logs, rocks,

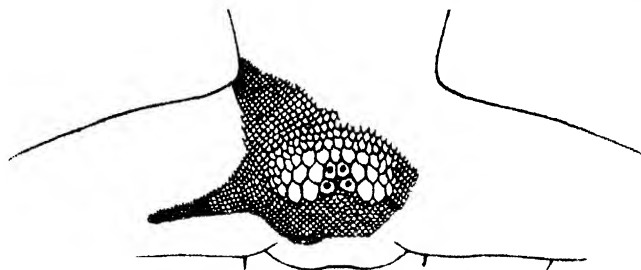


FIG. 1. *Gymnodactylus annulatus* Taylor, from Sulu, preanal pores, variation. $\times 8$.

rotten stumps, and in other similar habitats. These differ from the type specimen in having fewer preanal pores. There are three to five pores, four being the usual number. Slight differentiation was noted among specimens from different islands in the number, shape, and arrangement of the scales bordering the preanal pores. A very large series was preserved.

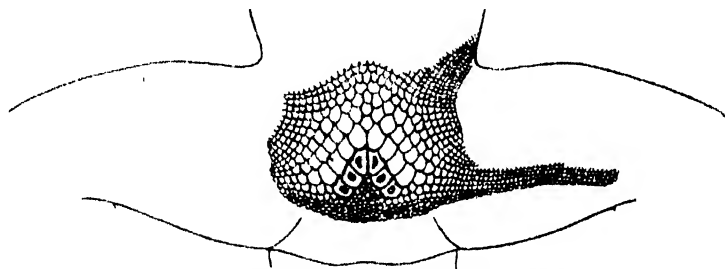


FIG. 2. *Gymnodactylus annulatus* Taylor, from Mindanao, preanal pores, typical. $\times 8$.

Gekko gekko Linnæus.

Specimens were taken on Jolo, at Siet Lake and Camp Roman-dier. A single specimen was obtained from Marongas Island near Jolo. Their unmistakable call was heard on several other islands, but no others were taken. The females have the preanal scales perforated, and they resemble the preanal pore scales of the males, save that the perforations are distinctly smaller.

Gekko monarchus Duméril and Bibron.

Two specimens were obtained on Bongao at an elevation of about 500 meters. They were found hiding under the loose bark of a tree, 3 meters from the ground. Both specimens are females

and are much darker than specimens from Mindanao. The white granules on the back form rather indistinct transverse lines. The median double row of black spots is present but dim, with some spots confluent.

Cosymbotus platyurus Schneider.

Specimens were taken in Zamboanga, Basilan, Bongao, Simonor, and Sitanki. The cutaneous expansion from axilla to groin is apparently wider in these than in specimens from Negros or Manila with which they were compared.

Hemidaectylus frenatus Duméril and Bibron.

Very common throughout the Archipelago; numerous specimens were taken.

Peropus mutilatus Weigmann.

A very common forest species, present on nearly all the islands visited.

Luperosaurus joloensis sp. nov. Plate I, fig. 8; text fig. 3.

Type.—No. 1872, female, Bureau of Science collection; collected at Siet Lake, Jolo, September 22, 1917, by E. H. Taylor.

Description of type.—Snout squarish, the rostral upright, longer than broad, with two slight depressions in the upper part, entering from near the median internasal; nostril surrounded by a raised prominence consisting of rostral, first labial, a postnasal, and two supranasals; last three scales coequal; eleven upper labials, the last two very small, second and third larger than first; a row of slightly enlarged scales above the upper labials, those immediately behind the postnasal largest; mental almost triangular, differentiated from the labials; a pair of hexagonal chin-shields followed by a single median scale; eleven lower labials, last three very small; eighth upper and eighth lower labials below center of eye; two or three rows of scales bordering the lower labials slightly enlarged; forehead concave, the granules on the snout larger than those on back or occiput; ear opening narrow, oblique; granules on the side and on part of head and neck intermixed with numerous spinelike scales; no lateral fold, but several enlarged scales arranged in a more or less regular row from axilla to groin; a fold of skin present about legs, more prominent on the posterior aspect of hind legs; scales on belly larger than on throat or back; a row of enlarged scales in the femoral and preanal region, sixteen on each side beginning on the knee and meeting medially at a broad angle, some of the scales apparently perforated; behind

this row, in front of anus, an angular row of much enlarged scales; anus not covered by an angular flap of skin; tail contained in distance from snout to vent one and one-half times; tail tapering gradually, rather flattened below; the annulations distinctly marked above; laterally two spinelike scales on each annulation pointing backward; scales on upper side larger than those on back, the annulations marked by a transverse row of scales slightly more prominent than others; below, scales arranged in transverse rows, the annulations marked by a row of slightly larger scales; a single prominent scale below at the base of tail on either side; adpressed limbs meet; digits half-webbed; claws

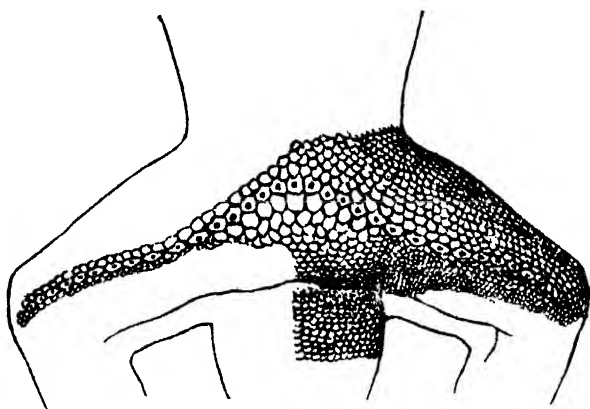


FIG. 3. *Luperosaurus joloensis* sp. nov., cotype from Jolo, preanal pores. About $\times 4$.

present on all save inner digits; lamellæ on outer extremities of digits divided, about six on longest toe, followed by a few undivided scalelike lamellæ; diameter of eye less than its distance from nostril or auricular opening.

Color in life.—Above russet brown, with indistinct grayish markings on side of snout, occiput, sides of neck, and across the back; below yellowish, mixed with flecks of brown. Tail indistinctly barred above; grayish brown below.

Measurements of Luperosaurus joloensis sp. nov.

	mm.
Total length	59
Snout to vent	36
Tail	23
Width of head	5.5
Length of head	10
Axilla to groin	17
Foreleg	10.5
Hind leg	14.7

Variation.—A second specimen captured in the same immediate locality is a male and consequently differs from the type (an adult female containing undeveloped eggs) in the presence of distinct femoral pores. There are thirty-one of these in a continuous series from knee to knee, forming a distinct arch in the preanal region. The tail is missing. The color is brown, with a wide occipital spot of gray and black mixed and five irregular bands across the back of gray and black intermixed. The length from snout to vent is 27 millimeters.

Remarks.—This species differs much from other known species of this genus. The presence of chin-shields, spiny scales on side of neck and head, the much fewer labials, and the large number and the arrangement of the femoral pores are all distinctive characters.

These two specimens were found at the base of a large tree under bark and small rocks. No other specimens were seen.

Hemiphyllodactylus insularis sp. nov. Plate I, figs. 6 and 7; text fig. 4.

Type.—No. 490, male, E. H. Taylor collection; collected at Sumagui, Mindoro, May 20, 1916, by E. H. Taylor.

Description of type.—Head oviform, much longer than broad, less than twice as high as wide; snout slightly longer than its distance from the auricular opening, one and one-half times the diameter of eye; eye large, pupil vertical; auricular opening small, irregular in shape; rostral much wider than high, subrectangular in shape, slightly notched above; nostril surrounded by the rostral, the first labial, and three nasals; the upper largest, separated from its fellow by two scales; eleven upper labials, last three minute; eleven lower labials; the mental triangular; no distinct chin-shields; scales bordering labials below, somewhat enlarged; granules on the snout distinctly larger than those on the back; latter minute, granular, equal; scales on belly cycloid, imbricate, larger than those on body above; no fold on body from axilla to groin; limbs rather small, failing to touch when adpressed; digits rather broad; the penultimate digit has two series of lamellæ, about four under the longest finger, followed by one or two paired scalelike lamellæ; longest toe with four lamellæ followed by two paired scales; a straight series of femoral pores on each side, ten on right, nine on left side, and a slightly angular series of eight preanal pores; tail cylindrical, tapering gradually.

Color in life.—General body color above light brown made up of varicolored scales—some brick red, whitish, black, brown,

and yellow; a series of brick-red dark-edged spots begins behind the eye and continues to tail; upper and lower labials dark, with a series of red spots along each jaw; pupil vertical, coppery red; belly and chin yellowish brown with numerous brown scales. Tail above with a large basal, red, black-edged spot; tail lighter with a dim series of paired lighter spots to the tip.

Measurements of Hemiphyllodactylus insularis sp. nov.

	mm.
Total length	56
Snout to vent	30
Tail	26
Head length	9
Head width	5
Foreleg	8
Hind leg	10.5
Axilla to groin	19

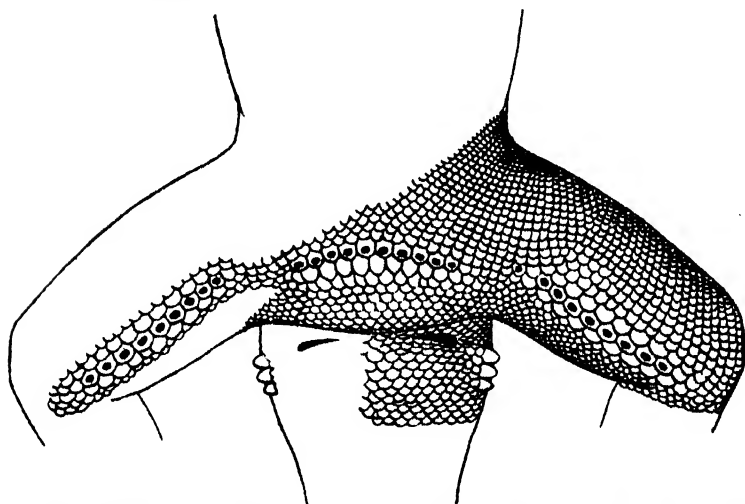


FIG. 4. *Hemiphyllodactylus insularis* sp. nov., type from Mindoro, preanal and femoral pores. $\times 10$.

Variation.—Very little variation is shown in the three other specimens taken in Mindoro. Five specimens taken in Jolo Archipelago are referred to this species. They are from the following localities: Cancuman, Dipolod, Marongas, and Bubuan (Tapián Group). They differ somewhat among themselves and also from the type in color. Specimens from the first three localities are light gray with a distinct black streak passing above labials through the eye and with a second along the canthus rostralis also passing through the eye, meeting at a point at the base of head medially; back mottled with darker color; a distinct dark spot on the base of tail above; the light spots

(red in the type) are evident in these specimens. The first row of scales bordering the labials is slightly larger than in the type. One is a male with ten to twelve femoral pores and seven preanal pores.

The Bubuan specimen is dark brown with darker brown reticulations; a short orange line behind the eye and small orange spots on the sides; a light, dark-edged mark on the base of tail above, as in the type.

Remarks.—This species is very closely allied to *H. leucostictus* Stejneger, if actually distinct. I have no Hawaiian specimens, but Stejneger's excellent description and drawings of the type are at hand.¹ The following differences are evident: The anterior labials are larger, and the posterior smaller, than in *leucostictus*; the eye is nearer the ear opening than end of snout; lateral scales on tail not pointed and raised, the preanal pores in a curved instead of an angular line. There are two or (usually) three scales separating the supranasals. The specimens from Sulu Archipelago have the chin-shields slightly enlarged, and in one specimen a single large scale follows the mental. All of these specimens were found along the seashore under bark of trees exposed to sun and usually reached by the sea water at high tide. Two small eggs are laid. These are joined to each other and attached under the bark of trees. The eggs are rather dirty or brownish white; the undeveloped eggs in the females are brown.

Lepidodactylus woodfordi Boulenger. Plate I, figs. 4 and 5.

Lepidodactylus woodfordi Boulenger, Proc. Zool. Soc. London (1887), 334, Pl. 28, fig. 1; DE ROOIJ, Rept. Ind.-Aust. Arch. (1915), 1, 51.

Description of species.—(From No. 1541, Bureau of Science collection). Head oviform, with a broad shallow groove on snout; a distinct depression between nostrils; rostral bent back over point of snout, broadly entering the nostril, highest at the suture with internasal; nostril surrounded by rostral, first labial, a supranasal, and two postnasals; supranasals separated by a single large scale, with a pair of small scales on each side; ten to twelve upper labials; mental differentiated in shape, but not larger than adjacent labials; ten lower labials, the last two or three of both upper and lower labials very small; largest chin-shields are four in number, one pair bordering the mental, the second immediately posterior to first pair (these scales are not equal, but vary in size); other scales touching these enlarged ones are smaller, rounding; granules on snout much larger than those on occiput

¹ *Proc. U. S. Nat. Mus.* (1899), 21, 800, figs. 7, 8, 9.

TABLE I.—Specimens of *Hemiphyllodactylus insularis* sp. nov.

No.	Locality.	Sex.	Snout to vent. mm.	Azila to groin. mm.	Lamellae under fourth toe.	Precanal pores.	Femoral pores.	Eye nearer ear than mouth.	Upper labials.	Lower labials.	Inter-nasals.	Collection.
480	Mindoro Island	♂	30	19	5	8	9-10	Yes	11	11-10	2	E. H. Taylor.
489	do	♀	32.3	17	4			do	10	10-11	2	Do.
491	do	♂	31	17	4	10	9-9	do	10	10-11	3	Do.
	do	♂	34	19	4	8	10-10	do	10-11	10-11	3	Do.
	Cancuman Island	♂	30	15	5	7	12-10	do	10-11	10-10	3	Bureau of Science.
	do	♀	34.2	18.5	4			do	12-12	12-12	3	Do.
	Dipolo Island	♀	36	20	5			do	11-10	11-11	3	Do.
	Marongas Island	♀	33.5	18.2	5			do	10-10	9-11	3	Do.
	Babuan Island	♀	34	18.2	5			do	12-11	10-11	3	Do.

or body; scales on belly large, cycloid, imbricate; scales on the tail arranged in transverse series, larger below than above, all larger than those on body; annulations indistinctly marked by series of slightly enlarged scales; scales on regenerated portion of the tail irregular and no annulations marked; a continuous series of twenty-four preanal and femoral scales in the preanal region, forming an angle medially; limbs moderately long, meeting when adpressed; digits well developed; inner toe long, well developed, lacking terminal digit and claw; third and fourth toes nearly equal; digits widened at ends, rather slender proximally, only a slight trace of web present; nine lamellæ under inner toe, the first single, the four following divided, last four narrower, rather scalelike; twelve under fourth toe, first four divided followed by three broad undivided lamellæ, these in turn followed by five scalelike lamellæ on the proximal portion of digit, not extending to the base. Eye large, distinctly nearer ear than snout, its diameter about one and one-half times in its distance from snout; ear opening very small, somewhat larger than nostril; tail rather cylindrical, noticeably flattened above and below, with a slight medial depression above and below; no lateral fringe, but the scales on the outer edge slightly raised.

Color in life.—Above gray with variegated scales of brownish and black and six black, irregular, zigzag lines across the back with lighter color between them; one or two indistinct darker lines across the snout and a few dark markings on occiput; a distinct black line from the nostril through the eye, which continues above the ear to the foreleg; tail pinkish gray with a series of dim transverse darker bars and a row of median black spots; also lateral rows of spots; below nearly uniform yellowish cream; labials with lighter spots.

Measurements of Lepidodactylus woodfordi Boulenger.

	mm.
Total length	71
Snout to vent	35.5
Axilla to groin	17.5
Tail, tip regenerated	35.5
Length of head	9.5
Width of head	7
Foreleg	9.5
Hind leg	14.5

Variation.—The seventeen specimens at hand show comparatively little variation; the number of pores or pore scales varies between twenty-one and twenty-five, the average being twenty-three. Occasionally they form a broad angle medially, but

usually the series is curved; the two median scales are largest and frequently are slightly separated. Upper and lower labials vary between ten and twelve. The scales between the supranasals are usually reduced to one large circular scale (only four specimens show exception). The arrangement of the chinshields is usually in two irregular curved rows, most of the enlarged scales are anterior to a line drawn from the posterior part of third labial across jaw. The regenerated tails have the scales arranged irregularly, the annulations not marked; the tail is much wider than deep in cross section. In color the specimens range from brown with rather heavy dark zigzag bars with lighter bars between to very light gray specimens with a few darker markings on back and no trace of zigzag lines; the young are dark laterally.

Remarks.—I have referred this group of specimens to Boulenger's species, since I can find no differences of any import between them and the published description and drawings of the type by Boulenger.² The color pattern shown on Boulenger's figure is almost identical with markings of living adult specimens taken. If the specimens are correctly identified, as I believe they are, they represent an interesting addition to our fauna. The nearest territory where they are known is New Guinea, the type locality being Faro Island, Solomon Islands.

TABLE II.—*Specimens of Lepidodactylus woodfordi Boulenger.*

No.	Locality.	Sex.	Snout to vent.	Head.		Axilla to groin.	Foreleg.	Hind leg.	Upper labials.	Lower labials.	Prenasal scales or pores.
				Length.	Width.						
			mm.	mm.	mm.	mm.	mm.	mm.			
1526	Santa Cruz Island.....	♂	40	10	6.8	20	10.5	16.2	10	11-12	24
1527	do.....	♂	39	10	7.5	18	11.8	17	11	10	21
1529	Great Govenen Island.....	♀	41	10.2	7.3	21.2	11.6	16	11	11	22
1530	Bubuan Island.....	♀	40	10	7.1	20	12	16	10-11	11-12	23
1531	do.....	♀	37	10	7.2	19	11	15.6	12	11	23
1532	do.....	♂	38	10	7.2	20	11.2	15.4	11	11	25
1534	do.....	♂	40	10	7.5	20	12	17	12-12	11	24
1537	do.....	♀	36	9.2	6.3	19.1	10	14	10	10-11	24
1540	Dipolod Island.....	♂	35	9	7	17	11	15.5	11-10	12-10	22
1541	Sipayu Island.....	♀	35.5	9.5	7	17.5	9.8	14.5	10-12	10	24

Lepidodactylus divergens sp. nov. Plate I, figs. 1, 2, and 3.

Type.—No. 2026, female, Bureau of Science collection; collected on Great Govenen Island, 1917, by E. H. Taylor.

² Loc. cit. Boulenger states that his specimen has no distinct web, but his fig. 12 shows a distinct rudiment as is present in Sulu specimens.

Description of type.—Head elongate, oviform; snout rather flattened, with a median groove; rostral more than twice as wide as high, rather low medially above, but raised on each side in front of nostrils; latter surrounded by rostral, first labial, two supranasals, and a large postnasal; the supranasals bordering rostral separated by three equal-sized scales; twelve upper labials; a row of scales bordering upper labials above, somewhat enlarged; twelve lower labials; the mental longer but narrower than adjacent scales; a group of enlarged shields under point of chin, the three pairs following the mental largest; almost all enlarged scales are anterior to a line drawn across chin from the sutures between fourth and fifth labials; granules on throat small, about equal to those on occiput and somewhat irregular in size; scales on belly cycloid, imbricate; in the preanal region a long series of preanal scales angular medially; tail much wider than deep, rounding above, noticeably narrowed at the base; flattened below with indications of a slightly sharp, dimly serrated lateral edge, the scales arranged in transverse rows, those above much smaller than those below, the annulations only dimly marked; limbs fairly well developed; digits well developed, except inner, which lacks the distal phalanx and claw; digits slightly wider distally; about ten lamellæ under inner toe, the outer single, the five following divided by a median suture; fifteen under fourth toe, five outer divided; diameter of eye contained in distance from eye to snout two and one-fifth times; eye to ear much less than distance from eye to end of snout.

Color in life.—Above russet to darker brown with numerous darker, narrow, zigzag lines, nine or ten from occiput to base of tail, with lighter areas between them, broad darker bands on tail, about eight to tip; a dark brown line from nostril through eye, which broadens slightly and continues some distance on neck; a yellow line above the brown, quite distinct behind eye; a row of yellow spots dorsolaterally from neck to base of tail; a few yellow flecks laterally; below yellowish, speckled with brown; variegated reddish brown on underside of tail.

Measurements of Lepidodactylus divergens sp. nov.

	mm.
Total length	80
Snout to foreleg	16.5
Snout to vent	41.5
Tail	38.5
Axilla to groin	20
Width of head	7.3
Length of head	12
Foreleg	11.2
Hind leg	16.2

Variations.—Table III shows clearly the variations in a series of nearly equal-sized specimens. Twenty-five specimens were taken, and all are females. All except two were taken on Little Govenen Island.³ These all showed the characteristic zigzag markings, and usually three short longitudinal dark stripes were present between the shoulders; the series of yellow spots were present on all specimens taken; the three scales between the supranasals are frequently replaced by a single large scale; there is also variation in the arrangement of the chin-shields, but the three pairs following the mental are usually largest. There is slight variation in the length of the snout; sometimes the diameter of eye is contained in the eye to snout distance less than two times. Regenerated tails are flatter and have a sharper, more prominent, serrated edge than normal specimens.

Remarks.—Not a single male specimen was found.⁴ This is especially surprising in view of the fact that so large a series was taken and in such a restricted locality. No explanation seems possible save that the males have different habits from the females and occupy some habitat that could not be discovered. All specimens seen were captured, so it could not be explained by their greater agility in escaping capture. This is another species "closely allied to *L. lugubris*," but differs from it in several points. There is a much larger series of preanal scales (pores in males?); there are nearly twice as many lamellæ under the fourth toe (fifteen in the type). The color pattern is distinctly different; the body is crossed by the series of zigzag lines instead of having two median rows of spots present; there is invariably present a series of small yellow spots dorsolaterally on the body. A comparison of descriptions shows other differences.

³ Little Govenen is an extremely small island lying less than a kilometer from the southwest coast of Basilan Island. It contains only a few hundred square meters of land and rises to an elevation of about 15 meters. On my first visit twelve specimens of this species were taken on the bare rocks that jut from one side of the island. All of these, apparently, were females, and later a special trip was made to the island for the purpose of discovering the males. On this trip the entire island was searched, and eleven specimens were taken. These, too, were females. Later two more specimens were found on Bubuan Island and these also were females.

Many of the specimens contained partly developed eggs, and the sex of these could not be questioned; certain specimens were dissected by myself and others by Dr. E. S. Ruth, of the University of the Philippines, who pronounced all of them females.

⁴ In this connection one notes that of fifteen specimens of *Lepidodactylus lugubris* listed by Boulenger [*Cat. Liz. Brit. Mus.* (1885), 1, 165-166] only one is a male.

TABLE III.—*Specimens of Lepidodactylus divergens* sp. nov. in the Bureau of Science collection.

No.	Locality.	Sex.	Snout to vent.	Head.		Axilla to groin.	Fore-leg.	Hind leg.	Labials.		Pre-anal scales.
				Length.	Width.				Upper.	Lower.	
1542	Great Govenen Island	♀	40	11	7	17.3	12.2	16	11-12	11-12	33
1543	do	♀	42.5	12	7	20.8	13	15.6	12-13	11-12	33
1545	do	♀	43.5	12.2	7.8	22	12.5	16.2	11-12	11-13	32
1544	do	♀	43	12	7.2	20.2	14.5	17	12	12	35
1546	do	♀	44	12.2	7.3	22.6	13.2	17	12-13	12	33
1547	do	♀	42	11.5	7	22.2	12.2	17.5	12	12	32
1548	do	♀	40	11.8	7	21.8	12	16.3	12	11-12	33
1549	do	♀	43.8	12	7.8	22.8	13	17.2	12	12-13	32
1550	do	♀	41	11.5	7.1	20.8	12.5	16.5	12	11	32
1551	do	♀	40	11.3	7.2	19.8	12	15.1	12	11	34
1554*	do	♀	41.5	12	7.3	20	11.2	16.2	11-12	11-12	34

* Type specimen.

Draco rizali Wandollek.⁵ Plate II, figs. 3 and 4.

I have referred to this species the common *Draco* of Zamboanga and certain islands to the south.⁶ Males and females differ greatly in color. I append color descriptions of both sexes.

Female.—Metallic iridescent gray with dim narrow blackish brown reticulations, sometimes forming dim brownish bands across the back; a few indistinct whitish spots laterally; a large nuchal spot usually present, an interorbital dark spot, and dark markings or reticulations on side of head; shoulders with or without a greenish wash; tail gray to brown with broad fairly distinct bars of darker brown; belly cream-white reticulated with darker color; throat and chin reticulated with bluish. Wing membranes above, black slightly washed with gray, inclosing bright reddish to orange spots, lighter next the body and of deeper color near outer border; below light, with a light wash of yellow and several small black spots near upper and outer border.

Male.—Brilliant yellow-green, somewhat metallic, with occa-

⁵ The type was collected by Dr. Jose Rizal in Dapitan and was sent to the Dresden Museum together with other herpetological material. It was named for him by Wandollek.

⁶ I have not compared these with the type, but with a splendid photograph of the type taken by Professor Austin Craig, the plate of which is deposited in the Philippine Library. I was permitted to have prints made through the kindness of Professor Craig.

sional scales of lighter and darker color. Wing membranes darker with numerous (usually) roundish spots of bluish to yellowish green, the outer edge light salmon washed with gray. Head with the interorbital dark spot; the nuchal spot absent; dark markings either present or absent on the sides of the head. Below, belly and wing membranes salmon to brick-red, usually with only one large or small dark spot in the outer margin of wing; gular appendage canary yellow at tip, the remainder bright purple to wine color with a green wash at base; throat and chin with darker reticulations; belly with very dim reticulations of darker color either present or absent.

The males can make extremely rapid changes of color. They change from light to dark green, then to black or reddish brown in less than a minute and vice versa. When the brown specimens are placed in alcohol, the green returns largely and when fixed is blue green to blue, the salmon largely disappearing below. In consequence of the color changes the head markings vary considerably in preserved specimens.

The species was abundant in the coconut groves near the mountains in Zamboanga. Specimens were also taken on Bongao and Simonor. On the latter island they were especially numerous in the coconut trees. With the aid of the Samals a large series was collected in the village of Tubig Indangan. The species was seen in Jolo, but no specimens were acquired.

***Draco bimaculatus* Günther.** Plate II, figs. 1 and 2.

A single specimen was obtained in the mountains near Zamboanga (city). It is the smallest species of the genus found in the Islands. It was also observed in Tawitawi. The paper-white gular appendage and the slender body render it easily identified at a considerable distance.

***Draco cornutus* Günther.**

This species has been reported from Jolo by Werner.⁷ I failed to find it there.

***Mabuya multifasciata* Gray.**

Specimens were taken in Zamboanga, Bubuan (Tapiantana Group), Jolo, Bubuan (Tapiian Group), Papahag, and Bongao. Specimens from the last two localities have a broad brilliant brick-red stripe beginning behind the eye and continuing some distance along the side. It is present in both sexes. Those found on the other islands sometimes have an orange or light spot laterally, but it is absent in females.

⁷ *Mitt. Natur. Mus. Hamb.* (1910), 27 (2), 9.

Mabuya multicarinata Gray.

Taken at Zamboanga, Santa Cruz, Basilan, Great Govenen, Bubuan (Tapiantana Group), Dipolod, Bitinan, Jolo, Bubuan (Tapian Group), Bongao, Papahag, and Simonor. I am certain that I observed this species in Sitanki and on the coast of British North Borneo, near Tunku Point. These southern specimens differ but little from those in the more northern Philippine Islands, save that the scale rows are thirty-two to thirty-four, while the usual counts are twenty-eight to thirty in northern specimens.

Mabuya rudis Boulenger. Text fig. 5.

Mabuia rudis Boulenger, Cat. Liz. Brit. Mus. (1887), 3, 188, Plate 11, fig. 3; DE ROOIJ, Rept. Ind.-Aus. Arch. (1915), 1, 161.

Mabuia lewisi BARTLETT, Crocod. Liz. Borneo (1895), 93.

This is the first record of this species for the Philippines. In consequence, I have appended a description of it.

Description of species.—(No. 344, Bureau of Science collection; Papahag Island). Rostral rather small, wider than high, well visible above, slightly in contact with the frontonasal; internasal present, small, elongate, not in contact; frontonasal slightly broader than deep, in contact with the frontal behind; prefrontals rather large, separated, touching first and second supra-oculars; frontal narrow, elongate, not as wide as the supra-ocular region, much longer than the distance to end of snout, and longer than the parietal region; frontoparietals distinct, rather elongate, longer than the interparietal; parietals wider than long, not forming a suture behind the interparietal; a pair of large nuchals; four supra-oculars, the first much reduced, not touching the frontal; second very large, the only supra-ocular touching the frontal; nostril in a rectangular nasal pierced behind the vertical of suture of rostral and first labial; a postnasal; two frenals, the anterior much higher than the nasal, much smaller than second; two preoculars between first superciliary and the fourth labial, superior small; four labials anterior to large subocular; six lower labials, first small, third much elongate; mental narrow, followed by a postmental and two pairs of divided chin-shields, first pair in contact; temporals not or but slightly enlarged; six superciliaries, the first and third much the largest; lower eyelid scaly; ear moderate, tympanum deeply sunk, lobules projecting; scales in thirty rows around the body all keeled except the ten ventral; head scales somewhat rugose. Legs well developed, the adpressed hind limb reaches slightly beyond the

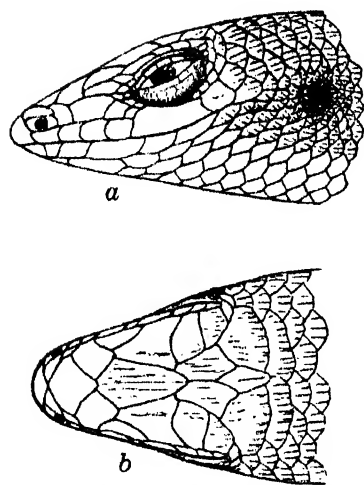


FIG. 5. *Mabuya rudis* Boulenger, from Sulu; a, side of head; b, top of head. $\times 2$.

shoulder; fourth toe much longer than third with twenty unicarinate lamellæ below. Anals not or but slightly enlarged; tail long, somewhat compressed, tapering very quickly behind anus; eye nearer the ear than end of snout; ear much nearer the foreleg than end of snout.

Color in life.—Above, head and body dark brown with some scales flecked with black; below, throat and chin bluish with black flecks, belly yellowish with black spots on many of the scales; underside of legs and base of tail grayish brown.

Measurements of Mabuya rudis Boulenger.

	mm.
Total length	229
Snout to vent	98
Snout to foreleg	34
Tail	136
Axilla to groin	44
Width of head	15
Length of head	22
Foreleg	35
Hind leg	50

Variations.—Two other specimens have been captured: one, an adult from Tawitawi; the other, a young example from Papahag. The first specimen does not differ from the described specimen save that the black spots on the back form continuous dotted lines, and there is a bright orange band along the side (greenish in alcohol). Throat bluish with indistinct bluish longitudinal lines; labials with black spots; tail flecked with white. The young specimen is olive green, with a broad black stripe beginning behind the eye; sides of neck and body greenish; below greenish white. De Rooij, (op. cit.) states that the range of scale rows is between thirty and thirty-six.

Remarks.—This species was first observed on Bitinan, a small island near Jolo, Sulu Archipelago. It was also observed on Jolo and on most of the islands visited to the south. The first specimen was taken on Tawitawi. It appears to be very common, but is extremely difficult to capture. It does not replace

either of the other species of *Mabuya*, *multicarinata* or *multifasciata*, since the three occur with the same apparent frequency on the islands from Bitinan to Sibutu Channel. I did not observe any of the three species on the Sibutu Group between Sibutu and Alice Channels, but I do not doubt that they are present, since the three species are known to occur in Borneo. Many of the specimens seen showed the anterior part of the body bright russet to orange; in others the orange was only present low on the sides of the body. It is extremely elusive, and specimens shot with an air rifle usually managed to escape. Unlike *M. multicarinata* and similar to *M. multifasciata* it takes refuge in holes in the ground, which are probably burrows made by it. It occurs in Sumatra, Java, Borneo, and Celebes. In the Philippines it is known only from Sulu Archipelago.

Sphenomorphus fasciatus Gray.

Several specimens were taken in Zamboanga and on Teipono Island. In both places they were found burrowing under logs.

Sphenomorphus variegatus Peters.

Specimens were obtained in Zamboanga and on Bubuan (Tapiantana Group), Bitinan, Jolo, Sangasanga, Tawitawi, and Bongao.

Sphenomorphus palustris Taylor. Text fig. 6.

Specimens were taken at Zamboanga and on Great Govenen and Bubuan (Tapiantana Group) Islands, but none was taken or observed farther south. It was present on the two islands named in large numbers. All have forty scale rows around the body and the distinct black and cream stripes on the side of head; the limbs have narrow light stripes on a blackish brown ground color. The hind limbs are almost black in adults. There are numerous transverse rows of light scales on the sides with black areas between them.

Sphenomorphus biparietalis sp. nov. Text fig. 7.

Type.—No. 1991, E. H. T. collection; collected on Lapac, Sulu Archipelago, September 28, 1917, by E. H. Taylor.

Description of type.—Head short; snout truncate; the rostral rather small, forming a broad straight suture with the fronto-nasal; latter wider than deep, minutely in contact with the frontal; prefrontals large, barely separated, touching minutely the first supra-ocular; frontal much longer than broad, scarcely as wide as the supra-ocular region, in contact with two supra-oculars; frontoparietals large, distinct, touching three supra-

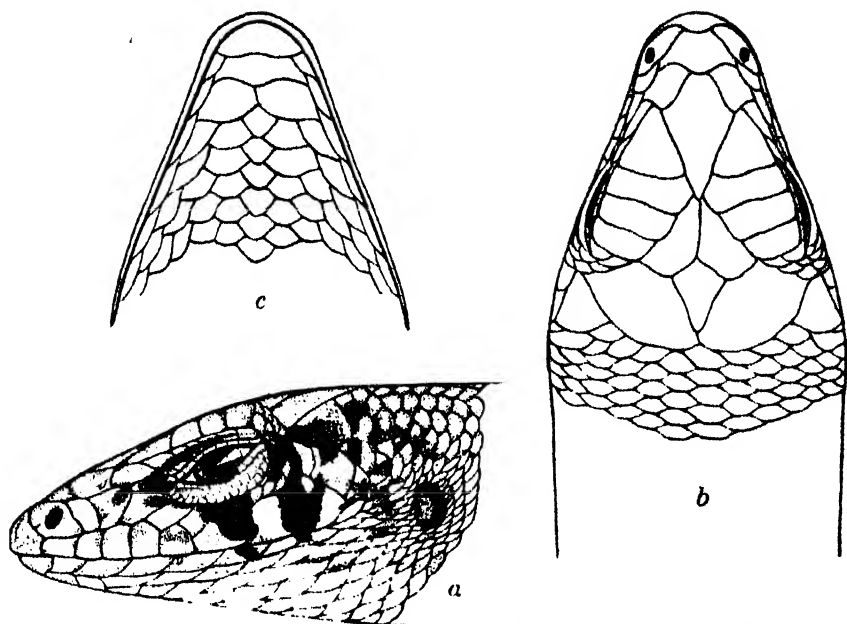


FIG. 6. *Sphenomorphus palustris* Taylor, from Sulu; a, side of head; b, top of head; c, c.in.
× 3.

oculars; interparietal small, longer than wide, parietals nearly rectangular, broadly in contact with each other behind the interparietal; a second pair of parietals between the first pair and the last supra-ocular, this pair much smaller, in contact with the frontoparietals, the last supra-ocular, and one or two small temporals; no nuchals; nostril pierced in a single nasal; nasal followed by one frenal; the latter followed by two pre-

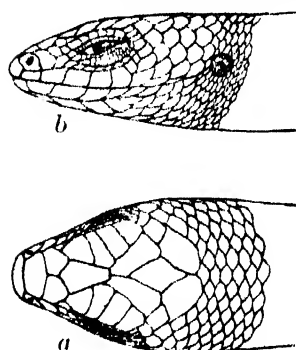


FIG. 7. *Sphenomorphus biparietalis* sp. nov., from Sulu; a, top of head; b, side of head.
× 4.

oculars between first superciliary and second labial; the lower largest; behind this a row of seven subequal scales separating the labials from the orbit; six upper labials, the third, fourth, and fifth below the eye; six lower labials; the temporals slightly enlarged; mental small, followed by a broad postmental; two pairs of chin-shields, both broad, first pair in contact broadly; ear opening large, round, tympanum not deeply sunk; limbs weak, failing to meet when adpressed by a considerable dis-

tance; thirty-two scale rows around body, those on belly largest, lateral rows in straight longitudinal lines; preanal scales not enlarged; third and fourth toes almost of equal length, ten smooth lamellæ under each; scales on underside of tail not enlarged; ear much nearer the foreleg than end of snout.

Color in life.—Above brownish, many of the scales flecked with whitish; a more or less distinct light-dotted line from behind eye along side; below this a stripe of slightly darker brown flecked with white; belly cream, underside of tail flecked with brown; upper and lower labials with light spots.

Measurements of Sphenomorphus biparietalis sp. nov.

Total length	mm. 70
Snout to vent	35
Snout to foreleg	11.5
Tail	35
Axilla to groin	21
Width of head	5
Foreleg	8
Hind leg	11

Variations.—Eleven other specimens are at hand for comparison. They are from various localities in the Archipelago, distributed as follows: Basilan, 1; Jolo, 4; Lapac, 2; Tawitawi, 1; Sangasanga, 1; Papahag, 2; Bongao, 1. The Basilan specimen is darker and is more heavily built; the head slightly broader, and scales in thirty-six rows about body; the prefrontals are broadly in contact; throat with black spots; two frenals present on right side. Specimens from Jolo are lighter, the two lateral light lines being more or less distinct. The type is from Lapac. Specimens from the more southern part of the Archipelago vary from thirty to thirty-four scale rows about the body. The labials vary between five and six.

Remarks.—This species seems to be very clearly differentiated by the arrangement of the parietals, which is different from that of any other species in the Islands. The only lizard in which this condition is approached is *Brachymeles vermis* Taylor, found on Papahag, near Tawitawi.

Riopa bowringi Günther. Text fig. 8.

Eumeces bowringii GÜNTHER, Rept. Brit. Ind. (1864), 91.

Euprepes (Riopa) punctatostriatus PETERS, Mon. Berl. Ak. (1871), 31.

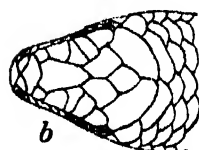
Lygosoma bowringii BOULENGER, Cat. Liz. Brit. Mus. (1887), 3, 308; Plate 28, fig. 3; DE ROOIJ, Rept. Ind.-Aus. Arch. (1915), 1, 264.

Lygosoma whiteheadi MOCQUARD, Le Natural. (1890), 12, 144; and Nouv. Arch. Mus. (1890) (3), 2, 184, Plate 8, fig. 3.

Description of species.—(No. 1990, Bureau of Science collection; collected at Siet Lake, Jolo, September 22, 1917, by E. H. Taylor). Snout rather obtuse, the rostral slightly visible above; supranasals present, in contact behind rostral; frontonasal much broader than long, broadly in contact with the frontal; prefrontals present, very small and very widely separated, leaving the frontal in contact broadly with the frontonasal; frontal longer than broad, as long as interparietal and frontoparietal; parietals in contact behind the latter; a pair of nuchals, and a large temporal borders the parietals; nostril pierced in a rectangular nasal, followed by two frenals, the anterior higher than the nasal and the posterior frenal; two preoculars between the first superciliary and fourth labial; seven superciliaries; four



a



b

FIG. 8. *Riopa bowringi*
Günther, from Jolo; a,
side of head; b, top of
head. $\times 3$.

supra-oculars, the first broadly in contact with the prefrontal; lower eyelid scaly; seven upper labials, the fifth large, below the eye; fourth as small as first; three or four enlarged temporals; six lower labials; mental rather wide, followed by a wide post-mental; three pairs of divided chin-shields, the first pair in contact, the third small; ear opening small, with two projecting lobules; twenty-six rows of scales about middle of body, all smooth; preanal scales somewhat enlarged; scales on underside of tail slightly larger than those above; limbs rather small, the fourth toe only a little longer than third;

thirteen lamellæ under fourth toe; tail thick, tapering very gradually. Eye nearer the end of snout than ear; the latter nearer the insertion of the foreleg than end of snout; adpressed limbs fail to meet by a considerable distance.

Color in life.—Above yellowish to dark brown, the scales on each dorsal row with black spots, forming more or less regular longitudinal dark lines; a broad black line begins behind the eye and continues above limbs to some distance on tail; scale row above black line, lighter than ground color; below black line, indistinct lines of brown with numerous distinct yellow punctations and occasional reddish brown scales; below orange to pink; rather pinkish in groin; a distinct white line along the upper labials.

Measurements of Riopa bowringi Günther.

	mm.
Total length (extreme tip of tail regenerated)	84.5
Snout to vent	42
Snout to foreleg	15
Axilla to groin	25
Tail	41.5
Width of head	5.1
Length of head	7.2
Foreleg	10
Hind leg	12.7

Variations.—Five other specimens from Jolo Archipelago are in the collection. They agree with the above description with few exceptions. One specimen has two pairs of nuchals, a second has the frontoparietals fused. All save the one described have twenty-eight scale rows. A young specimen in the collection is olive brown above. None of the specimens show evidence of carinations on scales.

Remarks.—This is the first record of this species from the Philippines. Its occurrence is hardly a matter of surprise, since de Rooij has identified Mocquard's *Lygosoma whiteheadi* from North Borneo as a synonym of this species.

The specimens obtained in Jolo Archipelago are from the following islands: Siet Lake, Jolo, 2 specimens; Lapac, 1; Bongao, 1; Simonor, 1; Tawitawi, 1. This species is also known from Borneo, several localities; Java; Celebes; Malacca; Siam; Burma; Hongkong.

Emoia atrocistatum Lesson.

It was observed or taken on all the islands visited; especially common along the coasts; numerous specimens were preserved.

Emoia cyanurum Lesson.

This species was taken only on Tulian, a small uninhabited rocky island near Jolo. It was not observed elsewhere. In the Philippines it is common on certain islands along the coast of Palawan. It is a matter of no small surprise that it was not taken or observed on the other Sulu Islands. If it is present, it is probably rare. Two of the specimens taken have brilliant blue tails with three greenish golden stripes on the back from snout to tail.

Dasia smaragdinum Lesson. Plate III.

Specimens were taken on Great Govenen and Bongao Islands. In the first locality they were especially numerous. Dorsally

the specimens are bluish green, anteriorly with many irregular dark spots mixed with small black spots and many smaller flecks; posteriorly the ground color is olive green to brown, the spots rather disappearing or uniting to form larger more regular spots; tail greenish.

The specimens from Bongao are olive to brownish green above with large black spots on the back of the head and many quadrangular black spots on the back with similar greenish white spots; tail olive gray with annulations dimly marked with whitish spots. Neither of these forms can be placed with the color varieties described and admirably figured by Barbour.⁸

***Tropidophorus rivularis* Taylor.**

A number of specimens were taken near Zamboanga. They agree with the type, except that the interparietal is not divided.⁹ I did not find this species in Sulu Archipelago. It is highly probable that this or a related species does occur on those islands that have running water. Species of this genus are constantly found along small fresh-water streams, usually under partly submerged rocks or logs.

***Brachymeles suluensis* sp. nov.** Text fig. 9.

Type.—No. 1989, female, Bureau of Science collection; collected on Bubuan Island,¹⁰ Tapiantana Group, Sulu, by E. H. Taylor.

Description of type.—Snout blunt, rather flattened; rostral bent back over end of snout, forming a moderate suture with the frontonasal; the latter longer than broad; prefrontals narrowly in contact, wider than deep, touching both frenals, first superciliary, and first supra-ocular; frontal large, a little longer than broad, in contact with two supra-oculars, narrowly in contact with the interparietal; the latter little longer than wide, much larger than the frontoparietals; parietals elongate, narrowly in contact behind the interparietal; no nuchals; nostril pierced in a minute nasal, followed by a small postnasal; anterior frenal nearly twice as large as the second; a small pre-ocular between the first superciliary and the third labial; five supra-oculars, second largest and widest; five or six supercilia-ries; six upper labials, first largest, fourth below eye; two small scales above the fifth labial; mental deeper than post-mental, but not as wide; three pairs of chin-shields, the first

⁸ *Mem. Mus. Comp. Zool.* (1912), 44, Pls. 1 and 2.

⁹ Probably anomalous in the type.

¹⁰ There are two islands in Sulu Archipelago by this name; one is in the Tapiantana Group, the second lies to the south in the Tapan Group.

pair in contact; second pair widest, separated by a single scale; third pair separated by three scales; ear opening minute, nearer end of snout than foreleg; twenty-four rows of smooth scales around body; preanals slightly enlarged; limbs pentadactyl, the anterior very short, reaching little more than halfway to ear; three scales above longest finger; five above longest toe; third and fourth toes subequal in length. Hind leg contained in axilla to groin distance five times.

Color in life.—Above and below light brown, each scale with a large slightly darker spot; a lighter stripe from behind eye to hind leg.

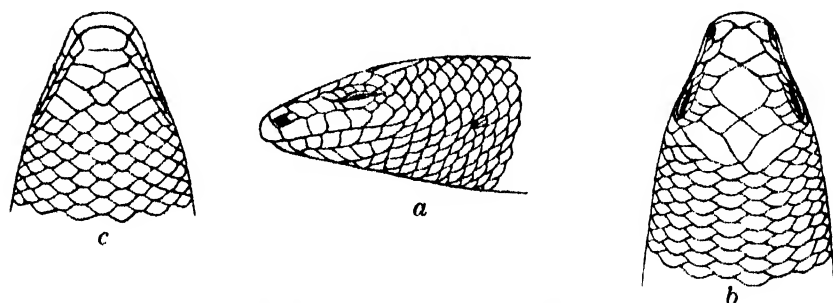


FIG. 9. *Brachymeles suluensis* sp. nov. Type from Bubuan; a, side of head; b, top of head; c, chin. $\times 3$.

Measurements of Brachymeles suluensis sp. nov.

	mm.
Total length	117
Snout to vent	81
Snout to foreleg	19
Tail, broken	38
Axilla to groin	55
Width of head	6.3
Foreleg	6
Hind leg	11

Remarks.—Only the type was found; it is an adult female containing embryos. This species forms another link in the chain of retrogression in the genus *Brachymeles*. It is between *Brachymeles schadenbergii* and *B. bicolor* and differs from both in the degree of development of the limbs and the relative length of the body.

Brachymeles vermis sp. nov. Text fig. 10.

Type.—No. 1980, Bureau of Science collection; collected at Bubuan, Tapian Group, Sulu, October 1, 1917, by E. H. Taylor.

Description of type.—Rostral about as high as wide, bending back over point of snout, visible above by more than half its

height; frontonasal broader than deep, broadly in contact with the rostral, narrowly with the frontal; prefrontal wider than long, narrowly separated, touching two frenals, first superciliary, and first supra-ocular; frontal slightly longer than wide, in contact with two supra-oculars and the interparietal; the latter longer than broad, inclosed by the parietals, with a prominent eyespot, larger than frontoparietals; latter separated, touching two supra-oculars; a pair of nuchals present; parietals more than three times as long as wide; five supra-oculars, first largest, second widest, last three touching the parietal; nostril pierced between the large supranasal and first labial (if a nasal scale is present it is apparently indistinguishable); two frenals, first nearly twice as large as the second; one large preocular; only two anterior superciliaries distinguishable; six upper labials, first very large, third and fourth below the eye; a scale partially inserted between the fourth and fifth labials; mental large, extending back to the vertical of near suture between first and second upper labials; four lower labials; postmental smaller than mental, touching one labial; three pairs of chin-shields,

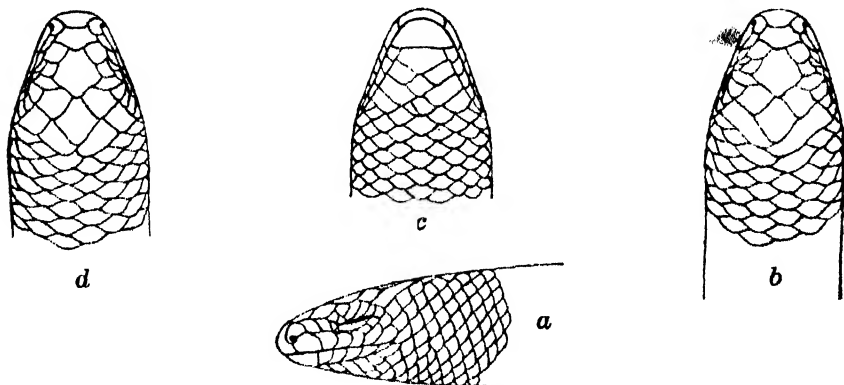


FIG. 10. *Brachymeles vermis* sp. nov., from Sulu; a, side of head; b, top of head (normal); c, chin; d, top of head (variation of Papahag specimens).

none in contact, second pair broadest, first two separated by a single scale, third pair by three scales; temporals slightly enlarged, two touching parietal; twenty-two scale rows around body, all smooth; preanals slightly enlarged. No limbs present; a slight depression laterally on either side of the anus with two or three elongate scales. No auricular opening; scales on anterior part of snout thickened.

Color in life.—Above light brown, each scale with a darker brown spot, making broken longitudinal lines; belly the same, slightly lighter.

Measurements of Brachymeles vermis sp. nov.

	mm.
Total length	144
Snout to vent	86
Tail	58
Width of head	4
Width of body	5

Variation.—Specimens were obtained in four localities: Bitinan, 3 specimens; Lapac, 4; Bubuan (south island), 3; and Papahag, 4. All show variations. Bitinan specimens have twenty-four rows of scales, and two have the nuchals much elongated and only one temporal touching the parietal; Lapac specimens have twenty-six scale rows; one specimen has the parietal broken on one side; Bubuan specimens, including the type, twenty-two scale rows; Papahag specimens all have the parietal broken in two parts. The first pair is small, about the size of the prefrontals; the second posterior pair elongate, forming the normal suture; they have twenty-two to twenty-four scale rows about the body.

Remarks.—This species is closely related to *Brachymeles burksi* Taylor and *Brachymeles bonitæ* Gray. It carries the retrogression of the genus another step, and we find the evolution complete from the highest developed forms, *Brachymeles gracilis* and *schadenbergii*, with well-developed pentadactyl limb, to this small legless form.

Brachymeles gracilis Fischer.

One specimen was obtained on Great Govenen Island and three specimens on Jolo Island. They agree very well with those from Negros and Mindoro. The hind leg is contained in the axilla to groin distance an average of three and one-tenth times; the development of the digits is slightly less than in northern specimens. It is a matter of no small surprise to find this species in Sulu Archipelago, as the known Mindanao species is *B. schadenbergii*.

Dibamus argenteus Taylor.

One specimen taken on Papahag; a second specimen was found at Tunku Point, British North Borneo.

SNAKES

Typhlops braminus Daudin.

Specimens were taken at Zamboanga and on Bongao.

Typhlops suluensis sp. nov. Text fig. 11.

Type.—No. 2001, Bureau of Science collection; collected on Bubuan, Tapanian Group, Sulu, October 2, 1917, by E. H. Taylor.

Description of type.—Snout rather pointed, with a moderately sharp edge; rostral nearly one-half the width of the head, rather truncate behind, forming a broad straight suture with the prefrontal; the latter very large, broadly triangular in shape, its longest sutures with the preoculars; frontal very small, bordered by six scales, about one-fifth the size of the prefrontal; interparietal as wide as the prefrontal, but somewhat smaller; supra-ocular slender, about two and one-half times as long as broad; parietals much larger than supra-oculars, little more than twice as long as wide; nasals separated, their upper ends barely extending beyond the posterior level of the rostral, which reaches almost to the anterior level of the eyes; nasal completely divided by the nasal cleft, which arises from the first labial; preocular in contact with two labials, not as wide as the ocular, its upper end scarcely reaching higher than the upper level of

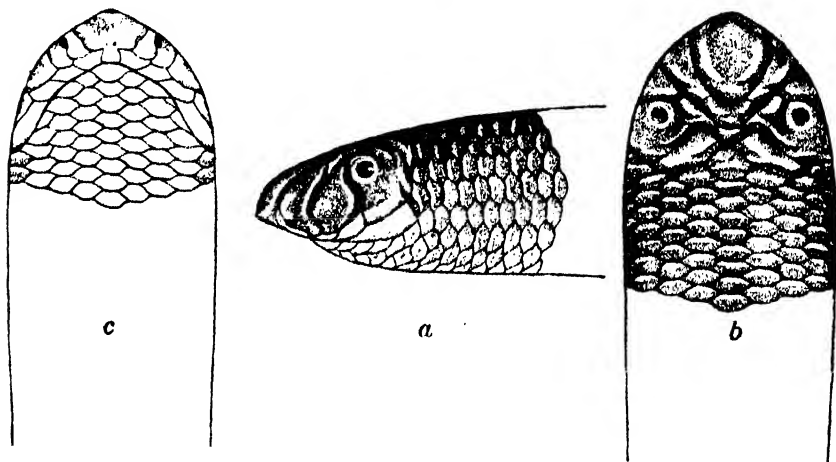


FIG. 11. *Typhlops suluwensis* sp. nov.; a, side of head; b, top of head; c, underside of head.

eye; eye distinct, with a minute pupil visible, not crossed by the suture of ocular with preocular; two body scales border the ocular behind; four lower labials, the second scarcely larger than the first; scales in twenty-two rows around middle of body; twenty on neck; twenty-two in front of anus; tail ending in a sharp spine.

Color in life.—Above dark drab gray covering nine whole and two half rows of scales, each scale with a slightly curved lighter area, which forms a fine-meshed network over the body, balance of body very light gray, the ventral median row of scales differentiated by being much lighter in color, with the outer edges and the edges of the adjacent scale rows slightly darker; occa-

sionally an entire scale is white in the median ventral row; tip of tail and anal region whitish; underside of head rather light dirty white; head with lighter curved markings arranged regularly, following somewhat the sutures of the head scales.

Measurements of Typhlops suluensis sp. nov.

Total length (mm.)	340
Tail (mm.)	18
Width of tail (mm.)	5.5
Width of body (mm.)	7.4
Width of the head (mm.)	5.5
Tail width in tail length (times)	2.4
Body width in body length (times)	46
Tail length in body length (times)	26

Remarks.—The type was obtained on Bubuan, Tapian Group, in Sulu Archipelago. It was found in a rotten log only about 4 meters from the high-tide mark on the beach. Much effort was made to obtain other specimens on this island, but none was found. This species seems to be most closely related to *Typhlops multilineatus* and *T. olivaceus*. From the former the following differences are evident: The rostral is shorter, the nasal completely divided, the diameter of body contained in total length forty times (in *multilineatus* fifty to sixty times), twenty-two instead of twenty scales around middle of body; the prefrontal larger, the frontal smaller; the color is not arranged in longitudinal lines. From *T. olivaceus* it differs in the complete division of the nasal, the preocular much narrower than the ocular, the rostral barely half the width of the head; the color is also different.

Python reticulatus Schneider.

No specimen taken. Reported as being present on Tawitawi, Basilan, and Jolo, where they are said to be fairly common.

Xenopeltis unicolor Reinwardt.

A mutilated specimen of what is presumably this species was brought to me by a Samal, in Bongao. Most of the head is missing, but the following body characters agree largely with specimens of this rare snake from Palawan. Ventrals, 168; anal divided; subcaudals, 28; scale rows, 15; three lower labials in contact with the anterior chin-shields. Body somewhat flattened, deep blue-black above, the three lateral rows of scales white-edged; outmost row white, with dim dark dots; ventrals white; a few scattered dark spots on the posterior part of body. Underside of tail black, the scales with white edges. Length,

325 millimeters; tail, 42. Known heretofore in the Philippines only from Palawan and Balabac.

Cyclocorus lineatus Reinhardt.

A specimen of this common species was taken in the mountains near Zamboanga.

Ablabes tricolor Schlegel.

One specimen of this very rare species was taken on Bubuan Island, Tapian Group. It was at rest in the branches of a low shrub. It agrees in remarkable detail with specimens from Palawan in regard to head scales. Ventrals, 137; anal divided; subcaudals (tip of tail missing), 103.

Holarchus meyerinkii Steindachner.

A single specimen of this rare snake was taken on Papahag Island, near Bongao. I regard this form specifically distinct from *Holarchus octolineatus* Schneider.¹¹ The species is also known from Tawitawi. The type locality is "Sulu Archipelago."

Dendrophis pictus Gmelin.

One specimen taken on Lapac; a second on Cagayan Sulu.

Dendrelaphis modestus Boulenger.

A single male specimen was taken on Bubuan, Tapian Group; it agrees very well with the type description in regard to scalation of head. The dark streak on the side of the head is very dim; there is a bright orange streak along the anterior part of body (almost disappearing in alcohol); ventrals, 175; tail with tip missing.

Elaphe erythrura Duméril and Bibron.

Three specimens of this species were taken in Bongao. It is reported as being common there.

Calamaria gervaisii Duméril and Bibron.

A single specimen was collected on Cagayan Sulu.

Psalmodynastes pulverulentus Boie.

Two specimens were obtained from near the top of Bongao Mountain, at an elevation of 700 meters. Both were under a small log. They show very marked color variations. One is very dark with slightly lighter mottlings; the other is gray

¹¹ See *This Journal*, Sec. D (1918), 13, No. 6 (in press).

with black spots and two light streaks behind the eye along both sides of the neck, continuing for the greater part of the distance along the body.

Crysopelea ornata Shaw.

One specimen was obtained on Bubuan, Tapanian Group; it is nearly uniform olive above, with each scale black-edged.

Laticauda colubrina Schneider.¹²

This snake was obtained on several islands. Many were observed in crevices in rocks, where they could not be readily taken; a large series was preserved.

Doliophis philippinus Günther.

A young specimen was taken in the mountains near Zamboanga.

NOTES ON ISLANDS VISITED

As most of the localities mentioned in this paper are recorded only on the Coast and Geodetic Survey chart, I append the following notes:

Zamboanga.—Province and town, southwest Mindanao. Collections were made in the mountains near Zamboanga, near or on the water reservation. Several specimens were also taken in the city of Zamboanga.

Santa Cruz Islands.—Two small, low islands lying off the coast of Mindanao about 2 kilometers from the city of Zamboanga. Covered with low brush. Few inhabitants.

Tictawan.—Very low, covered with dense mangrove forest; no land, very little beach, covered almost wholly with water; no inhabitants; 4 kilometers off Zamboanga.

Basilan.—A very large mountainous island almost entirely forested, 10 kilometers from Mindanao, separated by a channel, its greatest depth about 44 fathoms. Collections were made on the island at a point directly across from the mainland and on a rocky hill on the coast opposite Govenen Islands.

Great and Little Govenen.—Two islands, the first lying only a few hundred meters from the southwest coast of Basilan, the second less than a kilometer away. The first is a conical peak rising to about 200 meters, forested on top, cultivated on the

¹² A large sea snake, probably of this genus, but of a different species, was observed swimming on the surface of the water near Bubuan Island (Tapanian Group). The waves were running rather high, and the launch was upon the reptile before it was observed. It disappeared below the surface.

sides; the smaller island is only a few meters high and contains a few hundred square meters.

Teipono.—A low, flat coral island, 3 kilometers off the west coast of Basilan; very small, no inhabitants.

Tamuk.—Somewhat larger than Teipono; forested; 4 kilometers from Basilan; a ring of low land inclosing a larger swamp about the higher interior. Greatest elevation, 60 meters.

Cancuman.—A small flat island lying between Tamuk and the coast of Basilan, inhabited by a few families of Samals; forested.

Tapiantanas.—A group of islands lying from 4 to 10 kilometers south of Basilan; consists of three mountainous islands and a large flat coral island. Collections were made on Bubuan on the western side of the island. Elevation, 264 meters; heavily forested; greatest diameter, 2 kilometers. Very few or no inhabitants. Some wild boar.

Dipolod.—A very small, conical, rocky island in the Samales Group. Forested; no inhabitants; 22 kilometers from Basilan.

Mamanoc.—A small, low, flat island; one of the Samales Group, 0.5 kilometer long.

Bitinan.—A mountainous island off the northeastern coast of Jolo. Forested; uninhabited; elevation, 241 meters; has many wild cattle, no wild boar.

Jolo.—Large, mountainous, volcanic islands second to Basilan in size in the archipelago. Separated from the Samales Group by a channel 8.5 kilometers wide and at least a hundred fathoms deep. Collections made at Siet Lake and at Crater Lake, in the central part.

Marongas.—A small island 5 kilometers northeast of the port of Jolo; 92 meters high; low forest or brush.

Tulian Rock.—Seventy meters high, 50 meters wide, 200 meters long; low brush.

Bolipongpong.—An island in the Northern Tapul Group, separated from Jolo by a channel about 25 fathoms deep and 17 kilometers wide. The island is 7.2 kilometers long and 4 kilometers wide; elevation, 338 meters; forested. I stopped on the extreme southwestern point.

Lapac.—An island 30 kilometers south of Jolo. Partly forested; largely covered with cogon fields; inhabited. Collections were made on the extreme northern coast.

Tapaan.—A low coral atoll, covered with brush and mangrove; uninhabited. No reptiles were seen.

Bubuan, Tapul Group.—A mountainous, forested island; no inhabitants; elevation, 155 meters; 3 kilometers long and about

as wide. Reptiles especially abundant; collections were made on the southern and southeastern coasts.

Tawitawi.—A large mountainous island, 40 kilometers long; its greatest width, 15 kilometers. Heavily forested. I collected on the extreme southern point.

Bongao.—A small island separated from Sangasanga by a channel a few meters wide, which affords a passage for small boats and launches. Forested; inhabited; an elevation of 330 meters. Collections were made near the town of Bongao and on the large mountain of the same name.

Simonor.—A rather large, low, flat island, 9.5 kilometers south of Tawitawi, separated from nearby islands by water more than 40 fathoms deep. Collections were made at the town of Tubig Indangan.

Sibutu.—A very long, narrow island lying southwest of Tawitawi; separated from it by Sibutu Channel, 28 kilometers wide, and more than 100 fathoms deep; it is low, flat, and heavily wooded. A single small peak rising to a height of 165 meters; distant from the Bornean mainland, 29 kilometers. Collections were made on the western coast.

Sitanki.—A very small island surrounded by a great, shallow reef, separated from Sibutu by a deep, narrow channel; distance from the Bornean mainland, 41 kilometers.

Sipayu.—A very small, low sandy island separated from Tawitawi by a few hundred meters. Covered with brush and low trees.

Sangasanga.—A large island at the southern end of Tawitawi, separated by a channel only a few meters wide, which affords passage for barotos and vintas; forested. I collected on the southern end.

[illegible]

ILLUSTRATIONS

PLATE I

- FIGS. 1, 2, and 3. *Lepidodactylus divergens* sp. nov., from Great Govenen.
4 and 5. *Lepidodactylus woodfordi* Boulenger, from Bubuan.
FIG. 6. *Hemiphyllodactylus insularis* sp. nov., type, from Mindoro. Enlarged.
7. *Hemiphyllodactylus insularis* sp. nov., from Bubuan. Enlarged.
8. *Luperosaurus joloensis* sp. nov., type, from Jolo. Enlarged.

PLATE II

- FIG. 1. *Draco bimaculatus* Günther, female, from Mindanao.
2. *Draco bimaculatus* Günther, male, from Mindanao.
3. *Draco rizali* Wandollek, female, from Simonor.
4. *Draco rizali* Wandollek, male, from Simonor.

PLATE III

- FIG. 1. *Dasia smaragdinum* Lesson, variety, from Great Govenen.
2. *Dasia smaragdinum* Lesson, variety, from Mindanao.
3. *Dasia smaragdinum* Lesson, variety, from Bongao.

TEXT FIGURES

- FIG. 1. *Gymnodactylus annulatus* Taylor, from Sulu, preanal pores, variation. $\times 3$.
2. *Gymnodactylus annulatus* Taylor, from Mindanao, preanal pores, typical. $\times 3$.
3. *Luperosaurus joloensis* sp. nov., cotype from Jolo, preanal pores. About $\times 4$.
4. *Hemiphyllodactylus insularis* sp. nov., type from Mindoro, preanal and femoral pores. $\times 10$.
5. *Mabuya rudis* Boulenger, from Sulu; a, side of head; b, top of head. $\times 2$.
6. *Sphenomorphus palustris* Taylor, from Sulu; a, side of head; b, top of head; c, chin. $\times 3$.
7. *Sphenomorphus biparietalis* sp. nov., from Sulu; a, top of head; b, side of head. $\times 4$.
8. *Riopa bowringi* Günther, from Jolo; a, side of head; b, top of head. $\times 3$.
9. *Brachymeles suluensis* sp. nov., from Sulu; a, side of head; b, top of head; c, chin. $\times 3$.
10. *Brachymeles vermis* sp. nov., from Sulu; a, side of head; b, top of head (normal); c, chin; d, top of head (variation of Papahag specimens).
11. *Typhlops suluensis* sp. nov.; type; a, side of head; b, top of head; c, underside of head.

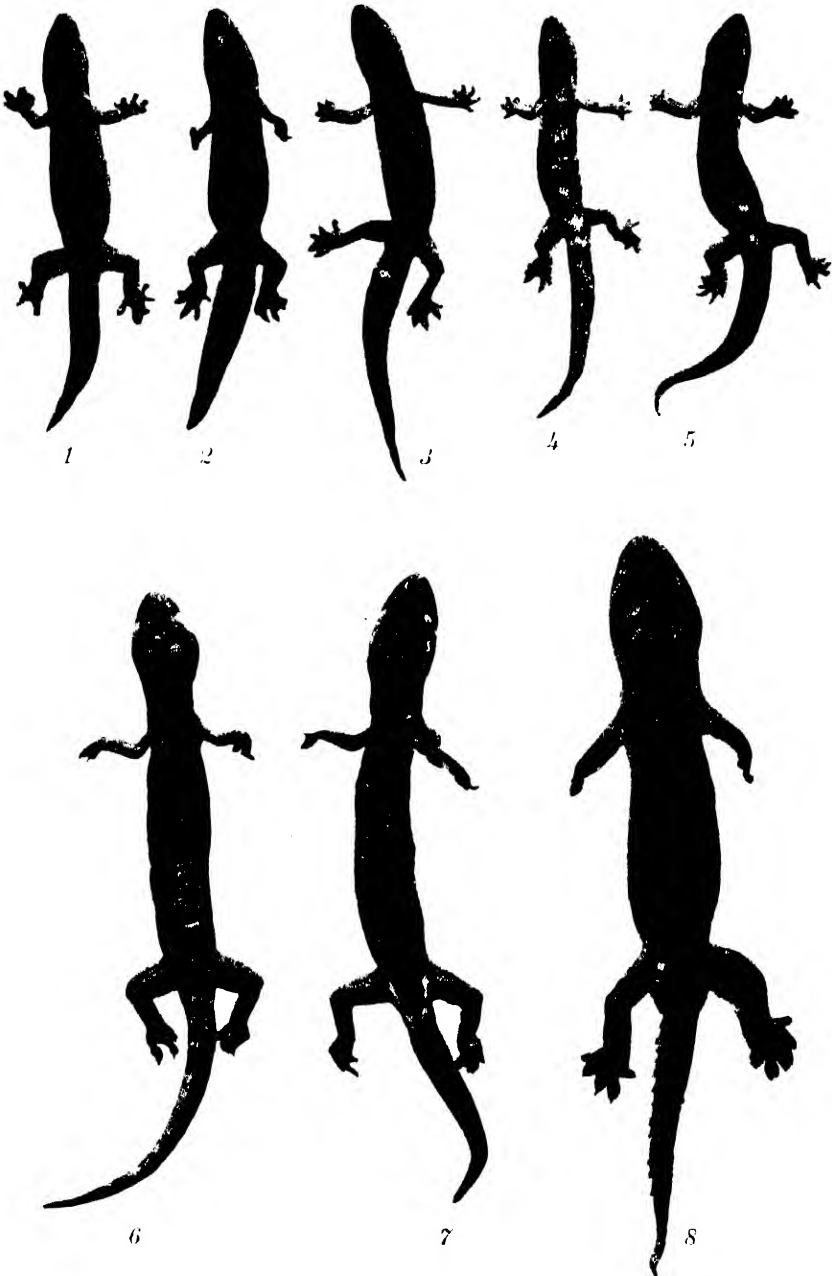


PLATE I. PHILIPPINE LIZARDS.

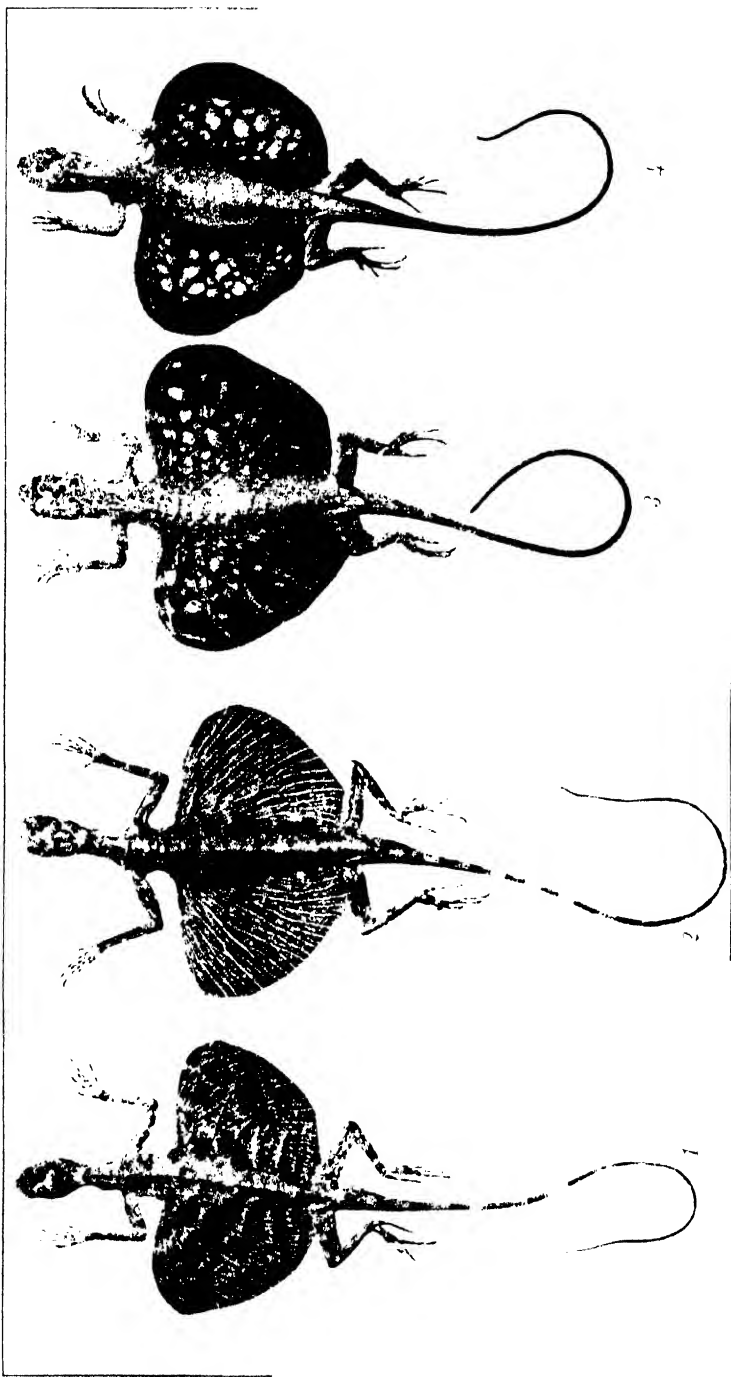


PLATE II. PHILIPPINE DRACOS.

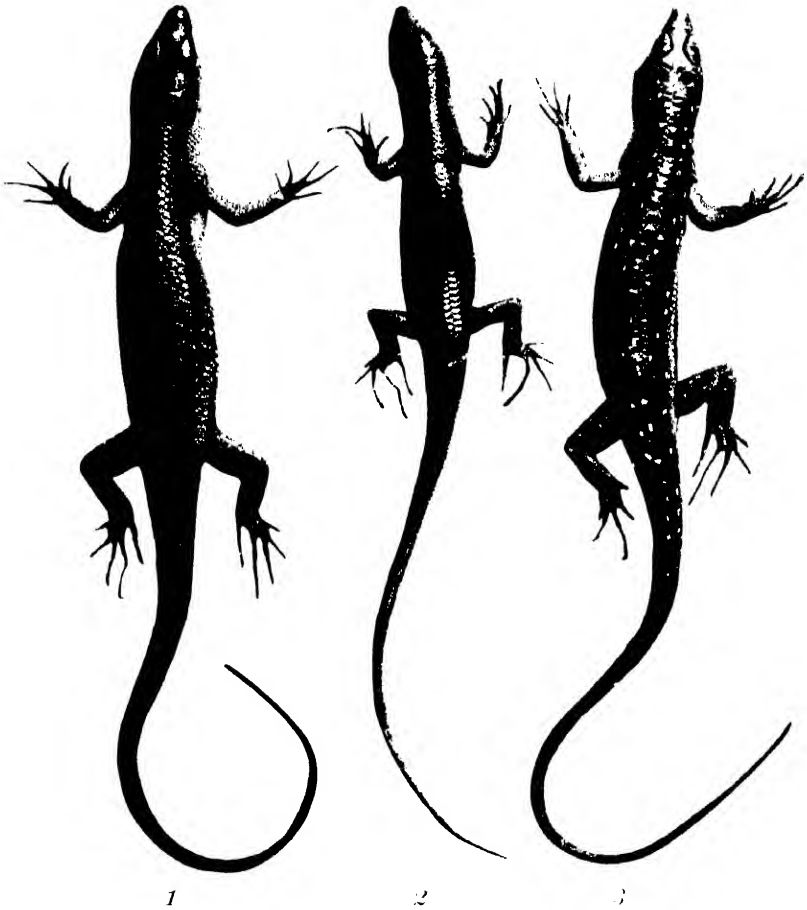


PLATE III. PHILIPPINE LIZARDS.

FIFTH CONTRIBUTION TO THE COLEOPTERA FAUNA OF THE PHILIPPINES

By W. SCHULTZE

(Manila, P. I.)

ONE PLATE

The genus *Alcides* Dalmann has been so far represented in the Philippine Islands by the following species:

<i>A. albocinctus</i> Blanch.	<i>A. pectoralis</i> Bohem.
<i>A. burmeisteri</i> Bohem.	<i>A. rutilans</i> Roel.
<i>A. crassus</i> Pasc.	<i>A. semperi</i> Pasc.
<i>A. decoratus</i> Roel.	<i>A. septemdecimnotatus</i> Roel.
<i>A. delta</i> Pasc.	<i>A. smaragdinus</i> Roel.
<i>A. leucospilus</i> Erichs.	<i>A. waltoni</i> Bohem.
<i>A. ocellatus</i> Roel.	

The above list seems rather small, in view of the fact that most of the Philippine *Alcides* are conspicuously colored and marked. Due to their peculiar coloration several authors¹ have mentioned certain species of the above genus in comparison with species of the almost exclusively Philippine genus *Pachyrrhynchus*. The diversity among certain groups of species² of the genus *Alcides* found in the Philippines as well as among those of other localities is noteworthy. For that reason it would be well to divide this large genus into subgenera should it be treated monographically.

In the Philippine Islands three main groups³ of species of *Alcides* are easily recognized, besides certain rather isolated forms. The first and largest group comprises species that are subcylindrical in general appearance, such as *A. albocinctus* Blanch. and *A. delta* Pasc. The second group consists of rather stout species, having greater shoulder width than forms of the first or third group and having for the most part, a conspicuous

¹ Pascoe, *Journ. Linn. Soc. London* (1870), 10, 462. Roelofs, *Tijdschr. voor Entom.* (1898), 36, 34. Bovie, *Wytzman's Genera Insectorum* (1908), fasc. 71, 2.

² Pascoe, *Ann. & Mag. Nat. Hist.* (1882), 9, 451.

³ This statement is based on over forty Philippine species of *Alcides* in my collection.

metallic luster. Species such as *A. ocellatus* Roel., *A. semperi* Pasc., *A. septemdecimnotatus* Roel., and *A. smaragdinus* Roel. belong to this group. The third group consists of species that are oval in appearance, represented by *A. pectoralis* and *A. waltoni* Bohem.

So far nothing seems to have been published of the biology of the Philippine *Alcides* species. For that reason the following may be of interest.

BIOLOGICAL NOTES ON *ALCIDES SEMPERI* PASCOE

Alcides semperi Pasc. inhabits the mountainous regions of central Luzon. It lives on *Aralia hypoleuca* Presl.,⁴ which is found scattered about in the ravines and valleys in the neighborhood of Baguio. On several occasions my attention was attracted to this plant by the dried-up appearance of the young shoots, usually one or two in number. I also noticed that from near the tip of the shoots a resinous substance was exuding. Upon close examination and by cutting the nearly dried-up tips, which is a rather disagreeable work, since the plant is beset very closely with very acute stiff thorns, I found a larva feeding on the pith, working from the top downward. The stem was hollowed, according to the size of the larva; in the case of a full-grown larva the hollowed-out part measured from 30 to 40 centimeters in length. Full-grown larvæ pupated readily in captivity. The adults that emerged proved to be *A. semperi*. The egg is evidently laid in the tip of the young shoot of the plant, the larva proceeding in the above-mentioned manner, feeding on the pith. During March and April I found the larvæ to be from half- to full-grown. In two cases I observed that the pupal stage lasted from ten to twelve days. The pupa is rather lively and is able to move freely up and down in the hollowed-out stem. After casting off the pupal skin, the beetle emerges only after three or four days have elapsed. Even then it is soft, and the markings are very faint and develop gradually as the beetle attains its natural hardness. The adults are common around Baguio during May and June, the beginning of the rainy season.

Two rather striking variations are prevalent, between which intermediate forms are very rare. One form is marked with rings,⁵ which are usually well separated from each other; and the other form is marked with round spots, which are large and

⁴ Kindly determined by Prof. E. D. Merrill.

⁵ Bovie, Wytzman's *Genera Insectorum* (1908), fasc. 71, fig. 3.

closely approach each other. The variation with the rings seems to be common around Baguio, whereas the one with the spots is found more in higher altitudes.

NEW PHILIPPINE ALCIDES SPECIES

The species hereafter described belong, with the exception of the last one, to the first group, characterized by the subcylindrical shape.

Alcides mindanaoensis sp. nov. Plate I, fig. 4.

Subcylindrical, black. Rostrum apically sparsely, toward the base coarsely and densely, punctured. An indistinct carina beyond the middle and an elongated depression terminating between the eyes, the latter with a punctiform impression. Vertex of head finely and uniformly punctured. Prothorax coarsely but sparsely punctured on the apical area, but the punctuation very coarse and confluent toward the base and lateral margins, almost granulate. A semicircular whitish band laterally less pronounced in the discal part. Elytra striate-punctate, the punctures coarse near the base. Each elytron in the basal half with a broad band arising posterior to the scutellum, extending obliquely to the lateral margin. Another curved band, at the second third of the elytra, interrupted at the suture. Apical triangle with a broad V-shaped spot. Underside densely punctured and beset with whitish scales. Legs sparsely punctured, finely and sparsely setose.

Length, 13 millimeters (without rostrum).

Width, 5.3 millimeters.

MINDANAO, Davao (*C. M. Weber*). Type in my collection.

Alcides insularis sp. nov. Plate I, fig. 5.

Subcylindrical, glossy black. Rostrum very finely and sparsely punctured. A shallow depression with a punctiform impression between the eyes. Prothorax closely and strongly punctured, the punctuation gradually confluent toward the base and the lateral margins. A creamy white almost round spot, laterally, near the apex and a narrow posterior marginal band. Elytra striate-punctate and finely rugose. Each elytron with a narrow band arising at the suture posterior to the scutellum, running obliquely, not quite reaching the middle, recurving toward the lateral margin, though not quite reaching the latter. Another band at the last third of each elytron from near the suture to near the lateral margin. Apical triangle with a V-

shaped stripe, the outer branch of which is very short. Underside densely and irregularly punctured, prothorax beset with creamy white scales. Spots at the lateral margins of the meso- and metathorax and abdominal segments, except the anal. Legs very glossy, finely and scatteredly punctured.

Length, 10 millimeters (without rostrum).

Width, 3.5 millimeters.

CATANDUANES ISLAND, Virac. Type in my collection.

Aloides merrilli sp. nov. Plate I, fig. 8.

Subcylindrical, black. Rostrum rather short, very finely punctured in the apical half, strongly and irregularly punctured toward the base and on the head. A fine carina in the basal half terminating in an oblong pit between the eyes. Prothorax granulate, except the apical area, where it is irregularly punctured, the surface covered with small irregular patches of scattered ochraceous scales. Elytra striate-punctate, moderately pronounced and coriaceous. The apical third of the elytra covered with rather regular small spots of scales. The underside is also coriaceous. The legs are glossy, relatively short and stout, and strongly and irregularly punctured.

Length, 9.5 millimeters (without rostrum).

Width, 3.5 millimeters.

LUZON, Zambales (pine region of Zambales Mountains). Type in my collection.

I name this interesting species in honor of the indefatigable Philippine botanist, Prof. Elmer D. Merrill.

Aloides mindorensis sp. nov. Plate I, fig. 1.

Subcylindrical, bluish black. Rostrum very finely punctured apically, coarsely toward the base. A shallow pit between the eyes. Vertex of head very finely and densely punctured. Prothorax sparsely punctured at the anterior margin, but granulate toward the posterior and lateral margin. A creamy white oblong spot at the anterior margin laterally and a band at the posterior margin. Elytra striate-punctate, well pronounced, the interstices finely rugose. Each elytron with a broad band, arising posteriorly of the scutellum and extending obliquely to the middle of the lateral margin. Beyond the middle another cross band, which is confluent with the former laterally, but separated again at each lateral margin. Apical triangle with a broad V-shaped stripe. Legs irregularly punctured.

Length, 13.5 millimeters (without rostrum).

Width, 5 millimeters.

MINDORO, Mansalay (*Edward H. Taylor*). Type in my collection.

Alcides luzonensis sp. nov. Plate I, fig. 7.

Subcylindrical, robust, glossy bluish black. Rostrum rather short, finely and sparsely punctured at the apex, coarsely and densely punctured laterally and at the base. A medial carina in the basal half terminating in a depression between the eyes. Vertex of head very finely variolosely punctured. Prothorax closely and coarsely punctured, especially toward the lateral margins. A white band at the fore margin interrupted discally and a posterior marginal band. Elytra striate-punctate, less pronounced than in the preceding species, the interstices finely rugose. A combination of white lines, forming on each elytron a figure like the letter X, the anterior tangents of which are longer than the posterior. The discal anterior tangents arise at the base next to the slightly raised scutellum. The two posterior discal tangents, which are rather short, form a curved transverse band behind the middle. A straight subsutural line in the apical third of each elytron recurved along the lateral margin and confluent with the posterior lateral tangent. Under-side closely punctured, prothorax beset with whitish scales, lateral margins of meso- and metathorax and abdominal segments with white spots, forming a band. Legs glossy, irregularly punctured.

Length, 11.5 millimeters (without rostrum).

Width, 4.5 millimeters.

LUZON, Laguna, Paete (*W. Schultze*). Type in my collection.

Alcides tagalicus sp. nov. Plate I, fig. 6.

Subcylindrical, slender, dark castaneous brown. Rostrum, apical half impunctate, basal half coarsely and confluent punctured, a carina ~~terminating~~ terminating in a shallow depression, very finely setose. Vertex of head minutely punctured. Prothorax very coarsely and confluent punctured, except at the apical area. An ochereous white discal lateral line from the anterior to the posterior margin. The same is spotlike, expanded at the anterior margin, and slightly curved. Scutellum roundish, with a punctiform depression. Elytra striate-punctate, the interstices very rugose. The combination of bands very similar to *A. luzonensis*, but more elongated. The bands at the base are continued along the margin, terminating in a spotlike expansion at the

shoulder. Underside very densely punctured and covered with ocherous scales. Legs slender, closely and confluent punctured.

Length, 12 millimeters (without rostrum).

Width, 4.5 millimeters.

LUZON, Rizal, Montalban (*W. Schultze*). Type in my collection.

Alcides catanduanensis sp. nov. Plate I, fig. 2.

Subcylindrical, black. Apical half of rostrum very finely and sparsely punctured, basal half coriaceous with a fine carina, which terminates in a pitlike depression between the eyes. Vertex of head finely punctured. Prothorax very closely and uniformly granulate. A creamy white band, interrupted in the middle, near the anterior margin; another along the posterior margin. Elytra striate-punctate, well pronounced and finely rugose. A sutural band from the base, running for a short distance posterior to the scutellum; it then forks and proceeds obliquely to the middle of each lateral margin. A transverse band at the apical third of the elytra becomes confluent at each lateral margin with the former. A narrow V-shaped stripe in the apical triangle of each elytron, one branch being subsutural, the other submarginal. Underside more or less covered with creamy white scales, especially the prothorax, also the meso- and metathorax and abdominal segments laterally. Legs glossy, very finely and scatteredly punctured.

Length, 14 millimeters (without rostrum).

Width, 5.5 millimeters.

CATANDUANES ISLAND, Virac. Type in my collection.

Alcides schuetzei sp. nov. Plate I, fig. 3.

Subcylindrical, black, very glossy. Rostrum apically finely, basally coarsely and confluent punctured. Basal half with a distinct medial carina terminating in a pit between the eyes. Vertex of head very finely punctured. Prothorax slightly constricted anteriorly, finely and regularly punctured. A whitish round spot laterally at the anterior margin, another larger spot at the posterior margin. Elytra very finely punctate-striate. Each elytron with five very large, roundish whitish spots, arranged in three cross rows—two basal, two medial, and one in the apical triangle. Underside with a small lateral marginal spot on the metathorax and each abdominal segment. Legs irregularly punctured.

Length, 12.5 millimeters (without rostrum).

Width, 4.5 millimeters.

LUZON, Benguet, Baguio (*O. Schütze*).

Named in honor of its collector.

Alcides taylori sp. nov. Plate I, fig. 9.

Robust, subcylindrical, castaneous brown. Rostrum moderately long, densely and irregularly punctured and rugose, and beset with scattered scales. Antenna with the second funicular joint longest. Vertex of head smooth. Prothorax slightly constricted anteriorly, closely and coarsely granulate, except at the apex. Scutellum rounded and slightly elevated. Elytra a little broader than the prothorax, coarsely punctate-striate, the punctures large and somewhat square, interstices rugose. The apex evenly rounded. A narrow creamy white stripe arising from the apex of the prothorax somewhat laterad, running obliquely to the base. This stripe is continued on the elytra, becoming somewhat broader and extending to behind the middle of each lateral margin, where it becomes expanded and confluent with an arched transverse band. The band is interrupted at the striae crossings. Underside and legs are densely punctured and beset with scattered scales, especially the abdominal segments. The tooth of the anterior femora is very small; the one on the medial and posterior femora is more pronounced.

Length, 14 millimeters (without rostrum).

Width, 5.8 millimeters.

MINDORO, Mansalay (*Edward H. Taylor*). Type in my collection.

I take pleasure in naming this species in honor of its collector.

In general aspect this species seems to be related to forms like *A. kirschii* Pasc.;* from the preceding Philippine species it is easily recognized by the sculptural differences.

Alcides taylori subsp. *panayensis* subsp. nov.

This subspecies differs from *A. taylori* in the following secondary characters: Thorax with a rather faint creamy white medial line across the disk from the anterior to the posterior margin and a well-pronounced narrow stripe at each lateral margin. On the elytra at the junction of the longitudinal stripe with the arched band the former is continued as a narrower stripe to the apical triangle and terminates in a V-shaped mark.

PANAY, Antique, Culasi (*R. C. McGregor*).

Several specimens of this interesting subspecies were collected by my friend Mr. McGregor in the mountains near Culasi.

* Pascoe, *Ann. & Mag. Nat. Hist.* (1882), 9, 449, Pl. 18.

BIOLOGICAL NOTES ON *PACHYRRHYNCHUS VENUSTUS*
WATERHOUSE

For a number of years, whenever collecting *Pachyrrhynchus*, I have endeavored to discover the immature stages of the various species, as well as their food plants and individual habits. To my knowledge there have been no published records on the biology of any species of this genus. As a rule, most species of the *Pachyrrhynchus-Apocyrtus* groups are found congregated in one locality, sometimes in large numbers on their supposed food plants. Since all of the species of the above groups are wingless forms and are, therefore, unable to fly, it seems rather strange that their breeding habits should be so difficult to discover. My efforts to discover something of the life histories of *P. congestus* Pasc., *P. modestior* Behr., and *P. pinorum* Pasc., which are rather common around Baguio, failed entirely; with *P. venustus* I was more successful. This species is found at the fresh-water swamp near Los Baños, the latter being an extension of the large lake, Laguna de Bay. This swamp contains no large trees, but a mass of shrubs, bushes, and a heavy growth of a peculiar fern.¹ The water in the swamp varies in depth from a few centimeters to a half meter or more at certain times. Since I had found most of the *P. venustus* climbing about on this fern, I examined this plant very closely. By cutting the leaves and the old leaf axils and splitting the trunk, or caudex, I finally located the larvæ and one pupa. The larvæ are found in the older, lower part of the trunk, which consists of alternating soft and very hard tissues. The larvæ feed in the soft parts, their channels being very short. The larvæ are oblong and of uniform diameter. The pupa was located in a

¹ Prof. E. D. Merrill kindly determined this fern and furnished the following description:

Acrostichum aureum Linnaeus.

A very coarse tufted fern from thick suberect root-stocks, which often form a distinct caudex. Fronds large, simply pinnate, 50 to 200 centimeters long, the pinnae oblong, coriaceous, entire, 20 to 50 centimeters long, 4 to 6 centimeters wide, somewhat stipitate, glabrous, apex obtuse to retuse, sometimes mucronate, the midribs stout, the veinlets distinct, freely anastomosing. The upper pinnae are fertile, wholly or in part, the sporangia densely covering the entire back of the pinnae or parts of them.

In brackish swamps throughout the Philippines, occurring also about mineral springs inland, such as those at Los Baños, and at Daklan, Benguet Subprovince. Near the seashore in all or most tropical countries. Tagalog name, *lagolo*.

crude pupal chamber near the exterior part of the trunk where the old leaf axils are located. It was creamy white when found, but upon being placed in alcohol, the latter acted as a fixative, since the pupa changed to light brown and the spots on the elytra became distinctly visible (Plate I, fig. 10). In general appearance the pupa is rather elongate. Anterior margin of clypeus and sides of the head beset with a few bristles. The meso- and metathoracical segments dorsally, somewhat laterad, beset with two thornlike tubercles, and the abdominal segments dorsally beset with a series of fleshy tubercles bearing a few short bristles. Anal segment dorsolateral with a more projecting tubercle and several smaller ones, each bearing a long bristle.

The beetles feed on the leaves of the fern, starting at the edges and devouring an oval piece about 2 centimeters long. *Pachyrrhynchus venustus* has the same common habit as have most species of *Pachyrrhynchus*. The beetles in climbing about and being approached at first try to hide by crawling on the underside of the leaf or on the reverse side of the stem, but if approached closely they instantly drop to the ground and remain motionless for some time. In the dense undergrowth it is very difficult to rediscover the beetle when it has dropped. The spots on the elytra of *P. venustus* Pasc. vary in number from 20 to 24 and are very pale lilac-colored.

On the leaves of the same fern I also found the interesting Buprestidæ, *Endelus bakeri* Kerrem.

ILLUSTRATION

[Drawings by W. Schultze.]

PLATE I

- FIG. 1. *Alcides mindorensis* sp. nov. \times 2.
2. *Alcides catanduanensis* sp. nov. \times 2.
3. *Alcides schuetzei* sp. nov. \times 2.
4. *Alcides mindanaoensis* sp. nov. \times 2.
5. *Alcides insularis* sp. nov. \times 2.
6. *Alcides tagalicus* sp. nov. \times 2.
7. *Alcides luzonensis* sp. nov. \times 2.
8. *Alcides merrilli* sp. nov. \times 2.
9. *Alcides taylori* sp. nov. \times 2.
10. *Pachyrrhynchus venustus* Waterh., pupa. \times 2.
11. *Pachyrrhynchus venustus* Waterh. \times 2.

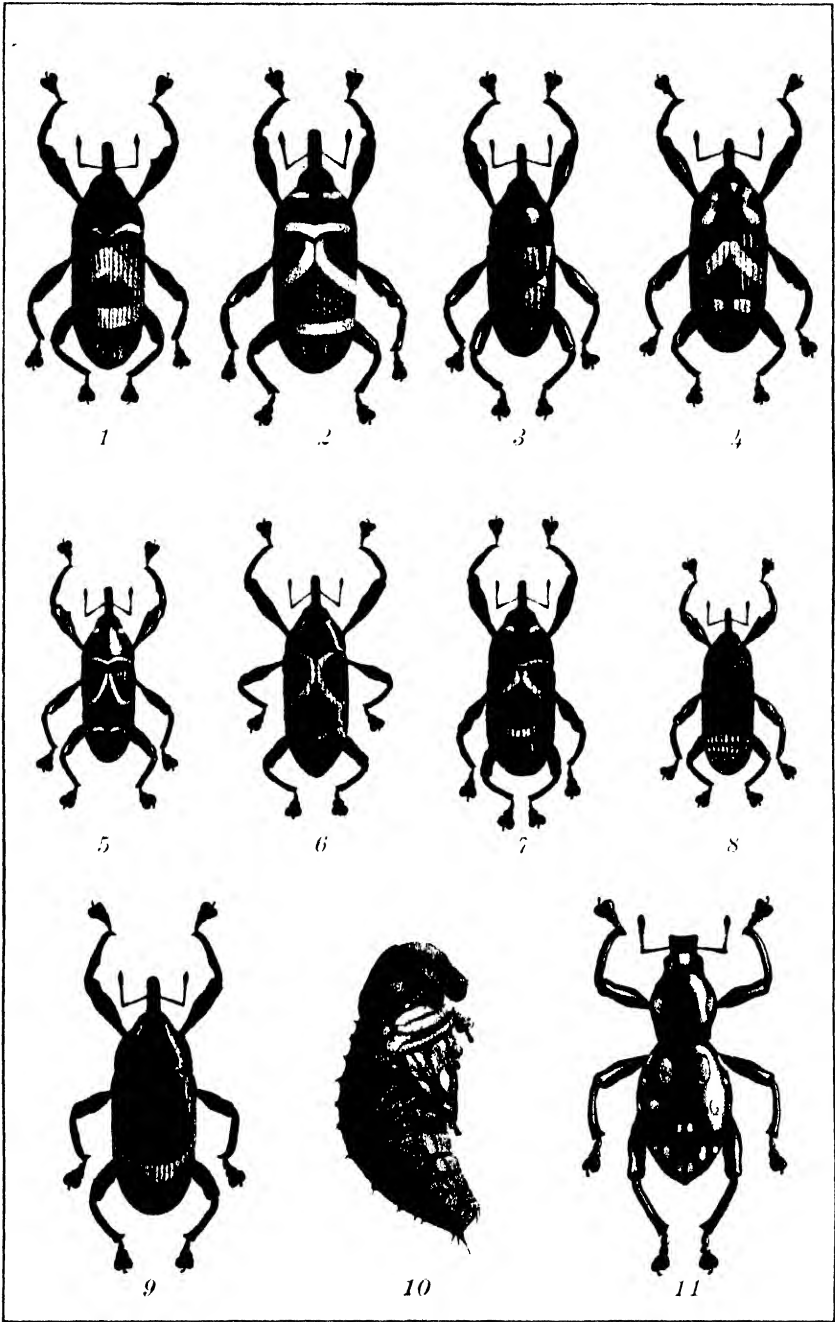


PLATE I. PHILIPPINE COLEOPTERA.

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NEW PHILIPPINE GALL MIDGES, WITH A KEY TO THE ITONIDIDÆ

By E. P. FELT

(*State Entomologist, Albany, New York*)

ONE PLATE

Comparatively little appears to have been done on the gall midges of the Philippine Islands, although several papers, in recent years, have discussed the insect galls of that general region, mostly without descriptions of the adults. It is probable that some of the deformities characterized earlier without the bestowal of scientific names are the work of species described below. There is a large and interesting gall-midge fauna in the Philippines, and this contribution is to be considered as only an introduction to work that should be prosecuted systematically and upon a much more extended scale, if there is to be an adequate understanding of this large group of minute forms.

The richness and diversity of the Philippine fauna is suggested by the fact that in the State of New York practically six hundred species, belonging to seventy-five genera, have been already recognized and the ground has been, by no means, thoroughly covered. Of the Itonididæ there are now known approximately three hundred genera and nearly three thousand species with much yet to be learned concerning the faunæ of subtropical and tropical regions.

The student will find J. J. Kieffer's work¹ one of the most comprehensive for the study of this group as a whole, and the references given in that volume serve as a ready index to a voluminous and widely scattered literature.

¹ *Diptera: Family Cecidomyiidae. Genera Insectorum, Fascicle 152 (1913).*

The present paper describes a number of species collected by Mr. Leopoldo B. Uichanco and transmitted for study by Prof. Charles S. Banks, College of Agriculture, University of the Philippines. The collection contained but fourteen species, all new. Five of these are referable to new genera, which are remarkable because of peculiar structures or notable specialization, such, for example, as *Kronodiplosis*, a member of the bifili easily recognized by the uniarticulate palpi; and *Kamptodiplosis* and *Heliodiplosis*, two genera allied to the peculiar subtropical *Kalodiplosis* Felt, though easily distinguished by the fewer and relatively longer circumfila,² the greater prolongation of the flagellate antennal segments of the male, and the shorter palpi.

Genus **LUZONOMYIA** novum

This genus is erected for a small midge presenting close affinities with *Oligotrophus* Latr., from which it is most easily separated by the distinctly produced basal clasp segment of the male and the small subapical terminal clasp segment.

Type of the genus, *Luzonomyia symphoremæ* sp. nov.

Luzonomyia symphoremæ sp. nov.

Male.—Length, 1.5 millimeters. Antennæ nearly as long as the body, dark brown, sparsely haired; 14 segments, first segment broadly obconic, second subglobose, third and fourth weakly fused, fifth with a stem one-fourth the length of cylindrical basal portion, which has a length about three times its diameter, a rather thick basal whorl of moderately long, stout setæ, a scattering subapical band of longer, slenderer setæ, and low circumfila at basal third and apicad; terminal segment missing. First segment of palpi short, irregular; second moderately broad, with a length about twice its diameter; third a little shorter than second, irregularly pyriform. Mesonotum dark yellowish brown, the fuscous yellowish submedian lines sparsely haired. Scutellum and postscutellum yellowish. Abdomen thickly haired, dark yellowish brown. Wings hyaline. Costa dark brown, subcosta uniting with margin at basal third, the third vein at apex, fifth at distal fourth, its branch at basal third. Halteres nearly uniform fuscous yellowish. Coxæ a variable dark brown. Legs mostly dark brown. Claws moderately long, slender, rather strongly curved apicad, simple, pulvilli a little shorter than claws. Genitalia: Basal clasp segment moderately long, stout, considerably swollen near distal third, at which point the terminal clasp

² Equivalent to Kieffer's "verticilli arcuati."—C. S. B.

segment is attached, the distal lobe being broad, broadly rounded and thickly setose, terminal clasp segment subapical, short, stout, somewhat curved, strongly chitinized and unidentate apicad; dorsal plate moderately long, broad, deeply and triangularly emarginate, the lobes rather thickly and irregularly rounded and margined with rather sparse, stout setæ; ventral plate moderately long, broad, deeply and narrowly incised, the lobes rather broadly rounded and sparsely margined with coarse setæ. Style moderately long, stout and broadly rounded apicad.

Female.—Length, 2 millimeters. Antennæ a little shorter than the body, reddish brown, sparsely long-haired; 14 segments, the fifth with a stem one-fourth the length of cylindrical basal enlargement, which has a length about three and a half times its diameter, a sparse basal whorl of rather stout setæ, a broad subapical band of longer, slenderer setæ, and low circumfila at basal fourth and apicad. Segments progressively somewhat shorter, twelfth with a length a little over twice its diameter, thirteenth with a length one and a half times its diameter, and fourteenth with a length a little greater than its diameter. First segment of palpi subquadrate, second rather broad with a length about two and a half times its diameter, third as long as the second and slightly dilated. Mesonotum dark yellowish brown, the yellowish submedian lines sparsely haired. Scutellum and postscutellum brownish yellow. Abdomen reddish brown, rather thickly haired; terminal segment somewhat darker. Ovipositor short, moderately stout, yellowish basad, and with a length about one-fourth the abdomen. The terminal lobes irregularly triangular and sparsely and coarsely setose. Halteres yellowish white, fuscous subapicad. Coxæ mostly pale yellowish. Legs dark brown. Other structures practically as in male.

Type.—Cecid. a2850, New York State collection; paratype, No. 18315, in College of Agriculture, Los Baños, P. I.

LUZON, Laguna Province, Los Baños and Mount Maquiling, 1917, College of Agriculture accession No. 18315 (*L. B. Uichanco*). A large series of this remarkable form was reared from leaf galls on *Symphorema luzonicum* F. Vill.

Genus *DICEROMYIA* novum

Allied to, though easily separated from, *Zalepidota* Rübsaamen by the greatly produced tapering spurs or horns at distal angles of terminal clasp segment. The subcostal cell is not remarkably broad. The female is unknown, but the characters of the male abundantly justify the above association.

Type of the genus, *Diceromyia vernoniæ* sp. nov.

Diceromyia vernoniæ sp. nov.

Male.—Length, 1.5 millimeters. Antennæ nearly as long as the body, dark brown, almost naked; 14 segments, first segment obconical; second short, the length a little greater than its diameter; the other segments cylindric, sessile; fifth with a length three and a half times its diameter; terminal segment somewhat produced, tapering slightly and with a length about four times its diameter. Each of the flagellate segments is rather thickly clothed with short, curved flattened hairs and has unusually heavy, strongly convoluted circumfila, somewhat suggesting the structure in *Schizomyia* Kieff. though lower and relatively thicker. Palpi much reduced, apparently composed of one short, broadly oval segment bearing a few stout setæ apicad. Mesonotum shining dark brown, the submedian lines sparsely haired, the median area lighter. Scutellum reddish brown. Postscutellum a little darker. Abdomen yellowish brown. Wings moderately broad, hyaline, subcosta uniting with margin near basal third, the third vein nearly straight and extending to apex of wing, fifth vein uniting with posterior margin at distal fourth, its branch near basal half. Halteres yellowish, transparent basad, reddish apicad. Legs a variable reddish brown. Claws moderately stout, strongly curved, simple; pulvilli nearly as long as claws. Genitalia small, basal clasp segment moderately long, stout, narrowly oval; terminal clasp segment with a length more than twice its diameter, the distal angles being produced as strongly chitinized tapering spines or horns, with a length nearly equal to diameter of segment; dorsal plate apparently divided, lobes divergent, narrowly oval, and sparsely setose; ventral plate deeply and triangularly emarginate, the lobes tapering to a narrowly rounded, setose apex. Style moderately long, narrow and tapering to a narrowly rounded apex.

Type.—Cecid. a2842, New York State collection.

LUZON, Laguna, Mount Maquiling, 1917, College of Agriculture accession No. 18143 (*Uichanco*), three males reared from leaf galls on *Vernonia lancifolia* Merr. No description of the gall was given, and the female is unknown.

Asphondylia vitea sp. nov.

Male.—Length, 2 millimeters. Antennæ as long as the body, light brown, thickly short-haired; 14 segments, the fifth with a length about three and a half times its diameter, the others successively longer, thirteenth having a length fully six times its diameter and fourteenth being still longer and slenderer.

Circumfla moderately stout. First segment of palpi short, subquadrate, second with a length nearly three times its diameter, third one-half longer than second. Mesonotum reddish brown, anterior lateral margins narrowly yellowish, sparsely haired. Scutellum and postscutellum yellowish. Abdomen reddish brown, rather thickly yellow-haired. Wings hyaline. Halteres reddish brown. Coxæ, femora, and tibiæ mostly yellowish brown; tarsi lighter. Claws moderately stout, pulvilli nearly as long as claws. Genitalia: Basal clasp segment very short, stout, subglobose; terminal clasp segment short, narrowly oval, heavily chitinized apicad and bidentate; dorsal plate divided, the lobes broadly oval, setose; ventral plate short, triangular, roundly emarginate distad.

Female.—Length, 3 millimeters. Antennæ as long as the body, light brown; 14 segments, fifth with a length about four times its diameter, thirteenth with a length about two and a half times its diameter, fourteenth with a length about three-fourths its diameter. First segment of palpi short, oval; second greatly produced, with a length more than six times its diameter and narrowly fusiform. Mesonotum dark brown, the submedian lines sparsely haired, the lateral angles narrowly yellowish. Scutellum and postscutellum yellowish brown. Abdomen dark reddish brown, rather thickly haired. Halteres yellowish brown. Coxæ dark brown. Legs a variable dark brown. Claws moderately heavy, strongly curved; pulvilli nearly as long as claws. Ovipositor when extended with a length about equal to the abdomen, the dorsal pouch moderately large and thickly clothed with short stout hairs.

Type.—Cecid. a2839, New York State collection; cotypes, male and female, Bureau of Science entomological collection No. 3252 (slide mounts) and No. 14267.

LUZON, Manila, 1905, Bureau of Science accession No. 3232 (*C. S. Banks*); Manila, 1907, Bureau of Science accession No. 6650 (*W. Schultze*), reared from stem galls on *Cissus trifolia* (L.) K. Sch.; Manila, 1910, Bureau of Science accession No. 14267 (*E. D. Merrill*). There was no description of the gall. This species is peculiar in the marked production of the distal antennal segments.

Asphondylia callicarpæ sp. nov.

Male.—Length, 1.5 millimeters. Antennæ nearly as long as the body, dark brown; 14 segments, fifth with a length about four and a half times its diameter, distal segment with a length about three times its diameter, each flagellate segment with

numerous short scalelike hairs and moderately stout circumfla. First segment of palpi short, quadrate; second with a length about three times its diameter, moderately stout; third a little longer and more slender. Mesonotum dark reddish brown, the submedian lines sparsely haired. Scutellum and postscutellum reddish brown. Abdomen dark reddish brown, sparsely haired. Wings hyaline. Halteres whitish basad, fuscous apicad. Anterior coxæ dark brown, mid and posterior coxæ reddish brown. Femora and tibiæ mostly pale straw, tarsi reddish brown. Claws moderately long, strongly curved, pulvilli a little shorter than claws. Genitalia: Basal clasp segment very stout, short, broadly rounded; terminal clasp segment very short, almost subglobose, strongly chitinized and bidentate apicad; other structures obscured in the preparation.

Female.—Length, 2 millimeters. Antennæ nearly as long as body, reddish brown; 14 segments, length of fifth segment nearly four times its diameter, thirteenth segment with a length a little over twice its diameter, fourteenth with a length about three-fourths its diameter. First segment of palpi probably subquadrate, second greatly produced with a length about five times its diameter and somewhat fusiform apicad. Mesonotum slaty brown, the submedian lines sparsely haired. Scutellum reddish brown. Postscutellum yellowish brown. Abdomen dark brown, basal portion of ovipositor yellowish orange. Halteres yellowish basad, fuscous apicad. Coxæ dark brown, femora and tibiæ basad mostly yellowish brown, distal portion of tibiæ and tarsi dark brown. Ovipositor, when extended, about as long as body, the dorsal pouch well developed.

Exuviae with thoracic horns stout and heavily chitinized, and with a rounded antennal margin finely and irregularly dentate. (Described from a fragment.)

Type.—Cecid. a2843, New York State collection; paratypes, male and female, No. 18147, College of Agriculture.

LUZON, Laguna, Mount Maquiling, 1917, College of Agriculture accession No. 18147 (*Uichanco*), reared from leaf galls from *Callicarpa erioclona* Schauer. There was no description of the gall.

Schizomyia acalyphæ sp. nov.

Female.—Length, 1.5 millimeters. Antennæ about one-half the length of the body, dark brown, rather thickly short-haired, basal segments yellowish; 14 subsessile segments; fifth segment with a very short stem; basal portion of second with a length over three times its diameter, thickly clothed with rather

long, dark, scalelike hairs and with a low heavy circumfilum at the basal third and apicad; twelfth segment with a length about twice its diameter; thirteenth with a length less than one-half greater than its diameter; fourteenth with a length a very little greater than its diameter. First segment of palpi short, irregular; second stouter with a length about twice its width; third one-half longer, slenderer; fourth a little longer and more dilated than third. Mesonotum yellowish brown. Scutellum and post-scutellum pale yellowish. Abdomen dark brown, rather thickly clothed with yellowish hairs. Ovipositor when extended nearly as long as body, basal portion yellowish brown, distal part moderately stout, slightly chitinized apicad and with distinct, triangular, sparsely setose lobes. Wings hyaline, third vein uniting with costa just beyond apex, fifth at distal fourth, its branch at basal third. Halteres yellowish, transparent. Coxæ pale yellowish. Femora mostly yellowish or yellowish brown. Tibiæ and tarsi dark brown. Claws moderately long, slender, evenly curved; pulvilli a little shorter than claws.

Type.—Cecid. a2848, New York State collection; part of type material, No. 18313, College of Agriculture, Los Baños, one pinned specimen and one microscopical slide.

LUZON, Laguna, Los Baños, 1917, College of Agriculture accession No. 18313 (*Uichanco*), reared from leaf galls on *Acalypha stipulacea* Klotz. The adults are quite different from those of *S. diplodisci* Felt in the shorter antennæ and decidedly less chitinized condition of the terminal portion of the ovipositor of the female.

Schizomyia diplodisci sp. nov.

Male.—Length, 2 millimeters. Antennæ a little shorter than body, dark brown, thickly short-haired; 14 segments, fifth subsessile, the stem about one-ninth the length of the subcylindric, slightly constricted segment, which has a length over three times its diameter. Circumfila stout, moderately low, the scalelike hairs half the length of the segment, rather thick and unusually stout. Terminal segment slightly produced, basal portion with a length about three and one-half times its diameter and with an irregular globose knob apicad. First segment of palpi irregularly ovate; second with a length three times its width, rather stout; third one-half longer, slenderer; fourth fully one-half longer than third, slenderer. Color as in the female. Genitalia: Basal clasp segment moderately long, stout, the distal portion produced as a narrowly rounded, thickly setose process; terminal clasp segment subapical, short, stout, recurved and

somewhat chitinous apicad; dorsal plate short, broad, deeply and roundly emarginate, the broad lobes broadly rounded; ventral plate a little longer, broad, broadly and roundly emarginate. Style slender, acute apicad.

Female.—Length, 2 millimeters. Antennæ nearly as long as the body, reddish brown, whitish basad, thickly haired; 14 segments, fifth subsessile, the stem about one-ninth the length of basal enlargement, the latter with a length fully four times its diameter and rather thickly clothed with dark, broad, scalelike hairs, each with a length about half that of the segment. First segment of palpi irregular; second with a length nearly four times its diameter; third a little longer, broader; fourth one-half longer than third, slenderer. Face yellowish. Eyes black. Mesonotum yellowish red, median area more yellowish, submedian lines rather sparsely clothed with fine setæ. There are also lines of long, stout setæ on the anterolateral margins. Scutellum pale yellowish, with a few stout, dark setæ. Post-scutellum yellowish. Abdomen a yellowish red, rather thickly clothed with short, stout setæ. Ovipositor when extended nearly as long as body, basal portion yellowish, distal part aciculate as in *Asphondylia*. Wings slightly fuscous, due to the rather thick covering of dark scales. Halteres yellowish basad, reddish yellow apicad. Coxæ mostly yellowish. Femora reddish brown. Tibiæ reddish basad, dark brown distad, the tarsi almost black.

Type.—Cecid. a2849, New York State collection; paratypes, male and female, No. 18314, College of Agriculture, Los Baños.

LUZON, Laguna, Mount Maquiling, August 29 and September 3 and 6, 1917, College of Agriculture accession No. 18314 (*Uichanco*), reared from terminal stem galls on lateral branches of *Diplodiscus paniculatus* Turcz.

Lasioptera manilensis sp. nov.

Female.—Length, 1.75 millimeters. Antennæ extending to base of abdomen, dark brown with a reddish cast, yellowish basad; 23 segments, fifth with a length nearly equal to its diameter, terminal segment subglobose or ovate. First segment of palpi subquadrate; second a little longer, broad; third more than twice the length of second, slender; fourth a little longer, slenderer than third. Face yellowish. Eyes black. Mesonotum golden brown, submedian lines and lateral areas rather thickly clothed with golden scales. Scutellum pale golden yellow. Postscutellum pale yellowish. Abdomen a rich, reddish brown, basal segment golden yellow, second to seventh segments

margined caudad with golden yellow scales, terminal segment yellowish. Wings slightly fuscous. Costa dark brown with anterior margin thickly clothed with golden scales, subcosta uniting with margin near basal third, third vein at distal third. Halteres, coxæ, femora, and tibiæ golden yellow; tarsi mostly dark brown; claws moderately stout, strongly bidentate, pulvilli as long as claws. Ovipositor when extended about one-third the length of abdomen, moderately stout; basad there is an oval patch of short, stout, thickly set chitinous spines; and the rather broad terminal lobes are ornamented dorsad with a series of moderately heavy, recurved, chitinous processes and laterad and basad with scattering and short, stout chitinous spines.

Type.—Cecid. a2851, New York State collection; paratypes, male and female, No. 18318, College of Agriculture, Los Baños, one microscopical mount labeled: "Type" No. 18318.

LUZON, Laguna, Los Baños and Mount Maquiling, 1917, College of Agriculture accession No. 18318 (*Uichanco*), reared from leaf galls on *Leea manillensis* Walp.

Genus **KRONODIPLOSIS** novum

This peculiar genus is easily distinguished from all other bifili by the unidentate claws and the uniarticulate palpi. Other distinguishing characters are given in the detailed description of the species.

Type of the genus, *Kronodiplosis uichancoi* sp. nov.

Kronodiplosis uichancoi sp. nov.

Male.—Length, 1.25 millimeters. Antennæ probably one-half longer than body, yellowish bronze, thickly haired; probably 14 segments, third and fourth apparently fused, fifth with stems one and a half and one-half their diameters, respectively, the basal stem being little more than a deep constriction of what otherwise would have been a cylindrical basal enlargement, each swelling with a moderately thick whorl of long, stout setæ and a circumfilum, the loops on basal enlargement extending nearly to middle of distal enlargement and those on the latter almost to apex of segment. Terminal segments missing. Palpi composed of one broadly fusiform, sparsely haired segment. Eyes large, black, confluent. Mesonotum nearly smooth and variable yellowish brown. Scutellum and postscutellum yellowish brown. Abdomen a little darker, thickly haired. Genitalia lighter. Wings hyaline, subcosta uniting with costa at basal third; third vein just beyond apex, fifth at distal fourth, its branch at basal third. Halteres yellowish, transparent. Coxæ yellowish. Legs

mostly pale straw. Claws on at least the anterior two pairs of legs moderately long, strongly bidentate, pulvilli as long as claws. Genitalia: Basal clasp moderately long, stout; terminal clasp segment moderately chitinized apicad; dorsal plate long, broad, deeply and roundly emarginate, the lobes somewhat divergent, broadly rounded and sparsely setose apicad; ventral plate long, broad, broadly and slightly emarginate; harpes indistinct; style long, slender, narrowly rounded apicad.

Type.—Cecid. a2847, New York State collection, paratype, male, No. 18307, College of Agriculture, Los Baños.

LUZON, Laguna, Los Baños, 1917, College of Agriculture accession No. 18307 (*Uichanco*), reared from leaf galls on *Barringtonia luzonensis* Rolfe.

Genus **KAMPTODIPLOSION** novum

This genus is allied to the subtropical *Kalodiplosis* Felt, from which it is most easily separated by the more produced flagellate antennal segments of the male, the longer circumfila with fewer and slenderer loops, the greatly reduced palpi, and the very short dorsal and ventral plates.

Type of the genus, *Kamptodiplosis reducta* sp. nov.

Kamptodiplosis reducta sp. nov.

Male.—Length, 1.75 millimeters. Antennæ one-half longer than body, bronzy yellow, thickly haired; ? 14 segments; first segment somewhat produced, subcylindric, with a length about one-half greater than its diameter; second hemispheric; third and fourth free; the stems of fifth each with a length about two and one-half times its diameter, the basal enlargement subglobose, with a subbasal whorl of long stout setæ and a subapical circumfilum, the loops moderately long, stout and not excessively numerous, distal enlargement subcylindric, with a length one-half greater than its diameter, slightly constricted near basal third, basad with a circumfilum, the loops moderately long, near the middle a whorl of long stout setæ and apicad a circumfilum, the loops a little longer and extending nearly to apex of segment; terminal segment missing. Palpi short; first segment irregularly quadrate; second a little longer, broadly oval; third as long as second, broadly oval. Mesonotum reddish brown, the submedian lines yellowish. Scutellum and postscutellum pale yellowish. Abdomen yellowish brown, rather thickly haired. Genitalia yellowish fuscous. Wings hyaline. Costa pale straw, subcosta uniting with margin near basal third, third vein well

beyond apex, fifth indistinct distad, joining posterior margin at distal third, its branch near basal third. Halteres pale yellowish. Coxæ yellowish brown. Legs pale straw. Claws moderately long, strongly curved, unidentate. Pulvilli as long as claws. Genitalia: Basal clasp segment rather long, stout; terminal clasp segment nearly as long, moderately stout and distinctly curved at distal fourth; dorsal plate short, broad, deeply and triangularly emarginate, the lobes somewhat divergent, obliquely truncate distad and sparsely setose; ventral plate short, broad, broadly and roundly emarginate, the lobes obtuse, each with a stout seta, style greatly produced and tapering to a narrowly rounded apex.

Female.—Length, 1.5 millimeters. Antennæ nearly as long as body, brownish yellow, thickly haired; ? 14 segments, fifth with a stem three-fourths the length of the cylindric basal enlargement, which has a length two and one-half times its diameter, a moderately thick subbasal whorl of long stout setæ, a subapical band of long, slenderer setæ and low circumfla, apparently anastomosing and extending from basal fourth to apex of enlargement. First segment of palpi short, irregular; second with a length nearly three times its width; third about two-thirds the length of second, somewhat expanded. Mesonotum a variable yellowish. Scutellum and postscutellum pale yellowish. Abdomen reddish, sparsely haired. Halteres, coxæ, and femora yellowish transparent. Tibiæ and tarsi pale straw. Ovipositor short, terminal lobes narrowly oval, tapering, subacute apicad and thickly clothed with coarse setæ.

Type.—Cecid. a2852, New York State collection.

LUZON, Laguna, Balong Bulo Hill, near Los Baños, 1917, College of Agriculture accession No. 18319 (*Uichanco*), reared from leaf galls on *Siphonodon celastrineus* Griff.

Genus *HELIODIPLYSIS* novum

The unidentate claws and the short triarticulate palpi show an affinity with *Kamptodiplosis*, from which this genus is easily separated by the structure of the ovipositor.

Type of the genus, *Heliodiplosis spatholobi* sp. nov.

Heliodiplosis spatholobi sp. nov.

Female.—Length, 1 millimeter. Antennæ nearly as long as body, sparsely haired; 13 segments, fifth with a stem one-third the length of cylindric basal enlargement, which has a length twice its diameter, a subbasal whorl of moderately stout setæ,

a subapical band of slenderer setæ and subbasal and apical, heavy circumfila, the loops of the former moderately short, those of the latter produced and extending almost to apex of segment. Terminal segment slightly reduced, with a length over twice its diameter and a knoblike apex. Palpi triarticulate, first segment subglobose, second broadly quadrate, third produced, tapering, with a length about four times its diameter. Eyes large, black. Mesonotum dark reddish brown, submedian lines fuscous yellowish. Scutellum and postscutellum reddish yellow. Abdomen dark reddish brown. Ovipositor fuscous. Wings hyaline. Costa dark brown, subcosta uniting therewith at basal third, third vein nearly straight and joining margin well beyond apex; fifth vein simple, subobsolete distad, uniting with posterior margin at distal third, its branch at basal half. Halteres yellowish basad, fuscous apicad. Coxæ dark brown; femora, tibiæ, and basal tarsal segments mostly dark brown; three distal tarsal segments yellowish red. Posterior legs a little darker than anterior and midlegs. Claws moderately stout, strongly curved, unidentate; pulvilli a little shorter than claws. Ovipositor when produced about one-third the length of abdomen; basal portion long, stout, somewhat chitinized, tapering; terminal lobes slender, with a length about five times the width and apicad with a few long setæ.

Type.—Cecid. a2853, New York State collection.

LUZON, Laguna, Mount Maquiling, 1917, College of Agriculture accession No. 18341 (*Uichanco*), reared from leaf galls on *Spatholobus gyrocarpus* (Wall.) Benth.

Profeltiella orientalis sp. nov.

Male.—Length, 1.5 millimeters. Antennæ probably a little longer than the body, bronzy yellow, thickly haired; ? 14 segments, third and fourth free, fifth with stems each two and one-half times its diameter. Basal enlargement subglobose, with a subbasal whorl of long stout setæ and a subapical circumfilum, loops of latter extending almost to the subcylindric distal enlargement, which has a length about one-fourth greater than its diameter, a subbasal circumfilum, with loops reaching nearly to tip of the enlargement, a subapical whorl of long stout setæ and an apical circumfilum, the loops of the latter extending almost to apex of segment. Terminal segment wanting. First segment of palpi irregular, subquadrate; second with a length nearly three times its diameter; third a little longer, moderately stout; fourth narrowly oval and a little shorter than third.

Mesonotum yellowish brown, scutellum and postscutellum yellowish, transparent. Abdomen pale yellowish, sparsely haired. Wings hyaline, long, narrow, with a length two and one-half times the width; subcosta uniting with costa near basal fourth; third vein curved distad, joining margin well beyond apex; fifth vein uniting with posterior margin at distal fourth, its branch near basal half. Halteres yellowish, transparent. Coxæ and femora mostly pale yellowish, tibiæ and tarsi pale straw. Claws wanting. Genitalia: Basal clasp segment moderately long, stout; terminal clasp segment long, stout, tapering, evenly curved; dorsal plate moderately long, broad, deeply and triangularly emarginate, the lobes sparsely setose and tapering to a narrowly rounded apex; ventral plate moderately long, broad, deeply and roundly emarginate, the lobes irregularly truncate and sparsely setose; style long, stout, narrowly rounded apicad.

Type.—Cecid. a2852a, New York State collection.

LUZON, Laguna, Balong Bulo Hill, near Los Baños, 1917, College of Agriculture accession No. 18389 (*Uichanco*). The one male described was reared in association with the unique *Kampodiplosis reducta* Felt from leaf galls on *Siphonodon celastri-nus* Griff. The generic reference is tentative. This species, like its German congener *P. ranunculi* Kieff.,¹ is quite possibly a predaceous inhabitant of other galls.

Tricontarinia luzonensis sp. nov.

Male.—Length, 1 millimeter. Antennæ one-half longer than body, light brown, thickly haired; 14 segments, third and fourth segments fused; fourth with stems each with a length twice their diameter, enlargements subglobose, the basal with a sparse whorl of moderately stout setæ and a circumfilum, the loops of the latter extending to base of slightly prolonged distal enlargement, which has subbasal and subapical circumfila, the loops of latter extending to apex of segment and a median whorl of moderately stout setæ. First segment of palpi subquadrate, second with a length about three times its diameter, third about as long as second. Mesonotum shining dark brown. Scutellum and postscutellum reddish brown. Abdomen yellowish brown. Wings hyaline, third vein uniting with margin just before apex, fifth at distal third, its branch near basal half. Halteres whitish. Coxæ yellowish. Femora mostly whitish. Tibiæ and tarsi dark brown. Genitalia: Basal clasp segment moderately long,

¹ Gen. Ins., Fasc. 152 (1918), 195.

rather slender; terminal clasp segment long, slender, slightly curved; dorsal plate moderately long, deeply and triangularly emarginate, the broad lobes divergent and broadly rounded apicad; ventral plate a little shorter, broad, broadly rounded; harpes short, stout, and with a dense fringe of long chitinized spines apicad; style long, slender, truncate.

Female.—Length, 1.5 millimeters. Antennæ nearly as long as body, reddish brown, sparsely haired; 14 segments, fifth with a stem as long as subcylindrical basal enlargement, which has a length one-half greater than its diameter and is strongly constricted near the middle; there is a sparse whorl of long, moderately stout setæ basad and near the middle a circumfilum with moderately high loops and another with loops one-half the length of the stem. Terminal segment somewhat produced, its length about three times its diameter and tapering to a broadly rounded apex. First segment of palpi irregular; second rather long, slender; third one-half longer, dilated. Mesonotum, scutellum, and postscutellum shining dark brown. Abdomen brownish red, fuscous basad. Halteres whitish, transparent. Coxæ yellowish. Femora and tibiæ pale straw, tarsi a little darker. Claws moderately long, slender, strongly curved, pulvilli a little shorter than claws. Ovipositor short, stout, the lobes narrowly oval and sparsely setose, otherwise nearly as in male.

Type.—Cecid. a2844, New York State collection; paratype, No. 18151, College of Agriculture, Los Baños.

LUZON, Laguna, Mount Maquiling, 1917, College of Agriculture accession No. 18151 (*Uichanco*), reared from leaf galls on *Parashorea malaanonan* (Blanco) Merrill. The generic reference is tentative, and from an examination of the insects I am inclined to believe that this species may be predaceous rather than phytophagous.

Hyperdiplosis banksi sp. nov.

Female.—Length, 1.75 millimeters. Antennæ probably nearly as long as body, dark brown, thickly haired; probably 14 segments, fifth with a stem about three-fourths the length of cylindrical basal enlargement, which has a length about twice its diameter, a sparse whorl of stout setæ basad and a similar whorl subapicad. First segment of palpi subquadrate; second long, irregular; third a little longer than second, slenderer; fourth a little longer than third, somewhat dilated. Eyes black. Mesonotum brownish yellow, the submedian lines a little lighter. Scutellum yellowish. Postscutellum reddish brown. Abdomen

a darker reddish brown, sparsely haired. Wings hyaline with a yellowish cast. Costa yellowish brown. Halteres yellowish, transparent. Coxæ reddish yellow. Femora, tibiæ, and basal tarsal segments mostly dark brown, distal tarsal segments lighter. Claws moderately long, strongly curved at nearly right angles, swollen distad, simple; pulvilli a little shorter than claws. Ovipositor short, terminal lobes with a length over four times the width, irregularly rounded apicad and sparsely clothed with long setæ.

Type.—Cecid. a2846, New York State collection.

LUZON, Laguna, Los Baños Falls, near Los Baños, 1917, College of Agriculture accession No. 18306 (*Uichanco*), reared from leaf galls on *Cissus adnata* Wall. var. The insect is somewhat larger than the species heretofore referred to this genus, and it is possible that on discovering the male it may be necessary to place this species elsewhere.

Hyperdiplosis relicta sp. nov.

Female.—Length, 1.5 millimeters. Antennæ about half the length of body, light brown, thickly haired; ? 14 segments, fifth with a stem three-fourths length of cylindric basal enlargement, which has a length about two and one-half times its diameter. Mouthparts somewhat produced, with a length about one-fourth the vertical diameter of head. First segment of palpi presumably short, irregular; second with a length about three times its diameter; third a little longer, slenderer; fourth as long as third, somewhat dilated. Mesonotum reddish brown. Scutellum and postscutellum a little lighter, rather thickly haired. Abdomen yellowish brown, thickly haired. Wings hyaline, third vein uniting with costa beyond apex of wing, fifth joining posterior margin at distal third, its branch at basal third. Halteres whitish, transparent. Coxæ yellowish brown. Legs mostly fuscous straw. Claws moderately long, slender basad, curved almost at right angles, distal portion distinctly swollen and tapering gradually to an acute, slightly recurved apex. Pulvilli about three-fourths the length of basal portion of claw. Ovipositor short, lobes narrowly oval, tapering slightly distad and rather thickly clothed with long setæ.

Type.—Cecid. a2841, New York State collection; paratype, No. 16015, College of Agriculture, Los Baños.

LUZON, Manila, 1911, Bureau of Science accession No. 16015 (*C. R. Jones*); the food plant is not recorded. The claws, in particular, are quite different from those of *H. banksi* Felt.

- a¹. Subcosta and third vein distinctly united as though by a very short cross vein. The fork formed by the two branches of the fourth vein even..... *Microcerata* Felt.
- a². Subcosta and third vein not fused and with no trace of a cross vein.
- d¹. Fork of the fourth vein with the two branches even.
Konisomyia Felt.
- d². Fork of the fourth vein with the branches irregular.
Tritoryga H. Lw.
- b¹. Second antennal segment normal.
- c¹. Flagellate segments not greatly reduced..... *Neptunimya* Felt.
- c². Flagellate segments sessile, with a length only a little greater than the diameter..... *Neocatocha* Felt.

CAMPYLOMYZARIÆ

*Key to the genera.**

- a¹. Wingless or, if wings are present, the fifth vein simple.
- b¹. Claws with long, parallel teeth, the pulvilli very short.
Strobliella Kieff.
- b². Claws denticulate, the pulvilli absent..... *Wasmanniella* Kieff.
- b³. Claws simple..... *Pezomyia* Kieff.
- a². Winged, fifth vein forked.
- b¹. Third vein usually well separated from costa and frequently uniting therewith at or beyond the apex.
- c¹. Flagellate antennal segments globose, stemmed in both sexes and ornamented only with whorls of long hairs.
- d¹. Fourth vein present.
- e¹. Palpi tri- or quadriarticulate.
- f¹. Wings normal, slender, antennal segments, male 14, female 11.
Joannisia Kieff.
- f². Wings broad, not twice as long as wide, antennal segments, female 12..... *Projoannisia* Kieff.
- e². Palpi biarticulate, the male with 14 and the female with 13 antennal segments, the claws strongly bent, dilated subapically..... *Peromyia* Kieff.
- d². Fourth vein wanting.
- e¹. Antennal segments stemmed..... *Trichopteromyia* Will.
- e². Antennal segments sessile, the second enlarged, globose; palpi triarticulate..... *Ceratomyia* Felt.
- c². Flagellate antennal segments with the enlargement transverse and bearing a whorl of stemmed disks..... *Xylopriona* Kieff.
- c³. Flagellate antennal segments cylindric, subsessile.
- d¹. Male with 12, female with 9 antennal segments, fourth vein rudimentary, obsolete distad..... *Mycophila* Felt.
- d². Female with 18 segments, the enlargements of the flagellate segments with a whorl of 4 awl-shaped appendages.
Tetraxyphus Kieff.

* Revised from *Bull. N. Y. State Mus.* (1913), No. 165, 154, 55.

b¹. Third vein rarely extending to the apex of the wing; flagellate antennal segments subsessile in the female, ornamented with crenulate whorls or other structures more complex than irregular whorls of simple hairs.

c¹. Palpi triarticulate.

d¹. Wings wanting, reduced or normal; antennæ with 14 or 15 segments, the enlargements with stemmed disks.

Pezomyia Kieff.

c². Palpi quadriarticulate, as a rule.

d². Antennæ very short, the male with 10 to 11, the female with 6 to 8 subsessile segments, the second greatly enlarged.

Micromyia Rond.

d³. Antennæ not very short, the male with 14, the female with 11 to 22 antennal segments, the second not greatly enlarged.

Campylomyza Meign.*

e¹. Flagellate antennal segments with a more or less distinct collar subapical, forming a more or less cup-shaped cavity.

f¹. Claws denticulate, the pulvilli well developed.

Prionellus Kieff.

f². Claws arched, enlarged slightly subapical and with transverse striations; the pulvilli about half the length of the claws.....

Prosaprionus Kieff.

f³. Claws simple.

g¹. Pulvilli short or rudimentary.....

Aprionus Kieff.

g². Pulvilli as long as the claws.

h¹. Ovipositor large, covered with long hairs, with two divergent lobes and a small lobe basad.

Urosema Kieff.

h². Ovipositor not as above, triarticulate.

Cylophora Kieff.

e². Flagellate antennal segments with a subapical whorl of stemmed disks.

f⁴. Claws with a minute subapical tooth.....

Monardia Kieff.

f⁵. Claws simple, a little shorter than the pulvilli.

Amblyspatha Kieff.

e³. Flagellate antennal segments with reniform processes subapical, claws bent at right angles, dilated subapical.

Bryomyia Kieff.

e⁴. Flagellate antennal segments with subapical whorls of short, stout, usually recurved spines.....

Cordylomia Felt.

e⁵. Flagellate antennal segments with series of whorls of short, stout, curved spines.....

Corinthomyia Felt.

* This genus is insufficiently defined and as here stated is practically of supergeneric value.

HETEROPEZINÆ

Key to the genera.*

- a^1 . Metatarsus longer than the second segment.
- b^1 . Tarsi quadriarticulate.
- c^1 . Three long veins.
- d^1 . Palpi quadriarticulate (in amber)..... *Meunieria* Kieff.†
- d^2 . Palpi triarticulate..... *Palpospaniocera* Meun.
- d^3 . Palpi biarticulate..... *Miastor* Mein.
- d^4 . Palpi uniarticulate..... *Peromiastor* Kieff.
- c^2 . One long vein, wings very narrow..... *Neostenoptera* Meun.
- b^2 . Tarsi triarticulate, 2 long veins.
- c^1 . Antennal segments cylindric..... *Heteropeza* Winn.‡
- c^2 . Antennal segments globose (in amber)..... *Monodicerana* H. Lw.†
- a^1 . Metatarsus shorter than the second segment.
- b^1 . Tarsi quinquarticulate.
- c^1 . Wing membrane finely haired.
- d^1 . Third vein extending to the apex of the wing.
- e^1 . Palpi quadriarticulate.
- f^1 . Fifth vein forked..... *Haplusia* Karsch.
- f^2 . Fifth vein simple..... *Johnsonomyia* Felt.§
- e^2 . Palpi triarticulate, wings acuminate..... *Meinertomyia* Felt.
- e^3 . Palpi uniarticulate, wings acute apically..... *Leptosyna* Kieff.
- d^2 . Third vein not extending to the apex of the wing.
- e^1 . Palpi biarticulate..... *Frirenica* Kieff.
- e^2 . Palpi triarticulate..... *Epimyia* Felt.
- c^1 . Wing membrane scaled.
- d^1 . Fifth vein forked, palpi quadriarticulate (in amber).
Ledomyiella Meun.
- d^2 . Fifth vein simple.
- e^1 . Four simple long veins, palpi biarticulate, antennal segments stemmed in the female..... *Kronomyia* Felt.
- e^2 . Three simple long veins, palpi triarticulate.
Brachyneura Rond. (*Spaniocera* Winn.).
- b^2 . Tarsi biarticulate..... *Oligarces* Mein.

* Revised from *Bull. N. Y. State Mus.* (1913), No. 165, 204.

† Location provisional.

‡ Kunstler and Chaine [*Compt. Rend. Soc. Biol.* (1902), 54, 535], give the characters of a form reared from bananas as follows: Tarsi biarticulate, the first segment longer than the second; wings with two or three long veins, the first two branched; palpi quadriarticulate. It was referred to the *Heteropezinæ* though no name was proposed and is presumably related to *Heteropeza* Winn. and *Monodicerana* H. Lw.

§ The Australian *Necrophlebia* Skuse and *Chastomera* Skuse are apparently closely related to this American genus and are provisionally associated therewith.

ITONIDIDINÆ

PORRICONDYLIARÆ

Key to the genera.*

- a'. Cross vein not parallel with costa, forming a well-marked angle therewith.
- b'. Four long veins, the fifth simple, the sixth free.
- c'. Fifth vein arising from the third near the cross vein, a supernumerary vein at the basal third of subcosta..... *Diallaetes* Kieff.
- c'. Fifth vein arising from the base of the wing, no supernumerary vein at the basal third of subcosta.
- d'. Fifth vein well developed; circumfila modified to form horseshoe-like appendages on opposite faces of the segment.
(Syn. *Winnertzola* Kieff.)
- d'. Fifth vein rudimentary, obsolete basad and apicad (Australian).
Gonioclema Skuse.†
- b'. Three long veins, the sixth a branch of the fifth or wanting.
- c'. Wings not very long and narrow, the cross vein at an oblique angle to costa.
- d'. Fifth vein forked, the sixth a branch of the fifth.
- e'. Fifth vein close to the posterior margin and uniting therewith near the basal half; palpi triarticulate; terminal clasp segment short..... *Bryocrypta* Kieff.
- e'. Fifth vein not close to the posterior margin, uniting therewith near the distal fourth; palpi quadriarticulate.
- f'. No supernumerary vein at base of subcosta; claws toothed; terminal clasp segment greatly produced, slender.
Didactylomyia Felt.
- f'. Supernumerary vein at base of subcosta; claws simple.
Liebliola Kieff. and Jorg.
- d'. Fifth vein simple, the sixth wanting.
- e'. Palpi quadriarticulate..... *Johnsonomyia* Felt.†
- e'. Palpi biarticulate..... *Colomyia* Kieff.
- a'. Wings usually very long, narrow, the cross vein almost at right angles to costa.
- d'. Fifth vein forked, the sixth a branch of the fifth; terminal clasp segment short, swollen, the claws usually simple.
Colpodia Winn.
- d'. Fifth vein simple, not reaching the wing margin.
Clinophæna Kieff.
- d'. Fifth vein simple, the sixth wanting (fossil).
Palæocolpodia Meun.
- a'. Cross vein parallel or nearly so with costa and apparently a continuation of the third vein.

* Revised from *Bull. N. Y. State Mus.* (1915), No. 180, 128-30.

† Location provisional.

‡ The absence of circumfila compels the reference of this genus to the *Heteropezinae*, though the superficial wing and antennal structures would place it here. It has therefore been included in the key simply to facilitate identification.

- b¹. Four long veins, the fifth simple, the sixth free.
- c¹. Fifth vein not obsolete basad.
- d¹. Distal portion of the abdomen not recurved dorsad.
 - e¹. Pulvilli longer than the unidentate claws; 16 or more antennal segments; ovipositor biarticulate..... *Asynapta* H. Lw.
 - e². Pulvilli shorter than the simple claws; 14 antennal segments; ovipositor triarticulate..... *Clitorhytis* Kieff.
- d². Abdomen slender, the distal portion recurved dorsally; claws toothed, the lobes of the ovipositor biarticulate.
 - Rübsaamenia* Kieff.
- c². Fifth vein obsolete basally; abdomen greatly produced, at least three times the length of the remainder of the body.
 - Dicerura* Kieff.
- b². Three long veins, the sixth a branch of the fifth or wanting.
- c¹. Fifth vein forked.
- d¹. Circumfila of the male not forming long loops or bows as in the *Itonidinarie*.
 - e¹. Palpi quadriarticulate.
 - f¹. Antennal segments of the male greatly produced, or at least with a distinct stem.
 - g¹. Abdomen not recurved dorsad.
 - h¹. Claws simple.
 - i¹. Pulvilli as long as or a little shorter than the claws.
 - j¹. Flagellate antennal segments of the male globose, elongated and constricted in the middle in the female..... *Porricondyla* Rond.
 - j². Flagellate antennal segments elongated and subcylindrical in the two sexes..... *Phænepidosis* Kieff.
 - i². Pulvilli rudimentary.
 - j¹. Flagellate antennal segments of the female with a stem one-half to three-fourths the length of the enlargement; lobes of ovipositor biarticulate.
 - Parepidosis* Kieff.
 - j². Flagellate antennal segments of the female sessile; lobes of the ovipositor very small.
 - Mysocosmus* Kieff.
 - h². Claws toothed.
 - i¹. Pulvilli as long as the claws.
 - j¹. Terminal clasp segment as long as the basal clasp segment, capitate apicad..... *Dicroneurus* Kieff.
 - j². Terminal clasp segment ellipsoidal, shorter than the basal clasp segment..... *Synaptella* Kieff.
 - i². Pulvilli reaching at most to the middle of the claws.
 - j¹. Third and fourth antennal segments fused.
 - Synarthrella* Kieff.
 - j². Third and fourth antennal segments not fused; terminal clasp segment a little longer than its diameter, almost truncate, the margin spined.
 - Prosepidosis* Kieff.
 - i². Pulvilli rudimentary.
 - j¹. Claws strongly curved, almost at right angles, the teeth equally long.... *Tetradiplosis* Kieff. and Jörg.

- g*². Abdomen slender, recurved dorsad..... *Camptomyia* Kieff.
*f*². Antennal segment not greatly produced in both sexes.
*g*¹. Basal clasp segment ovate, denticulate apicad; terminal
 clasp segment wanting..... *Dirrhisa* H. Lw.
*g*². Male genitalia presumably normal; flagellate antennal
 segments subsessile or nearly so; lobes of the ovipositor
 normal..... *Prodirrhisa* Kieff.
*e*². Palpi triarticulate..... *Lopesiella* Tav.
*d*². Circumfla of the male forming long loops as in the *Itonidinaris*.
*e*¹. Palpi quadriarticulate..... *Lopesia* Rübs.
*e*¹. Palpi uniarticulate..... *Allodiplosis* Kieff. and Jörg.
*c*¹. Fifth vein simple, the sixth wanting.
*d*¹. Claws denticulate, as long as the pulvilli or at most twice as
 long as the pulvilli..... *Holoneurus* Kieff.
*d*². Claws toothed, more than twice the length of the pulvilli.
Coccopsis Meij.

LASIOPTERIARIÆ

Key to the genera.

- a*¹. Third vein very near costa and uniting therewith at or before the basal
 half, very rarely near the distal third.
*b*¹. Mouth parts and thorax normal; that is, not greatly prolonged.
*c*¹. Palpi with three or four segments.
*d*¹. Third and fourth antennal segments coalescent or closely fused;
 pulvilli always well developed.
*e*¹. Three long veins, the fifth forked some distance from its base.
*f*¹. Ventral plate bilobed; palpi usually quadriarticulate.
Lasioptera Meig.*
*f*². Ventral plate straight, not emarginate; palpi triarticulate.
Prolasioptera Kieff.
*e*². Four simple long veins..... *Neolasioptera* Felt.
*d*². Third and fourth antennal segments not coalescent, at least
 separated by a distinct constriction; pulvilli sometimes small
 or rudimentary.
*e*¹. Palpi quadriarticulate; claws simple..... *Protaplonyx* Felt.
*c*². Palpi biarticulate or uniarticulate.
*d*¹. Third and fourth antennal segments coalescent or closely fused;
 pulvilli always well developed.
*e*¹. Palpi uni- or biarticulate, rarely triarticulate... *Asteromyia* Felt.
*d*². Third and fourth antennal segments not coalescent, at least
 separated by a distinct constriction; pulvilli sometimes small or
 rudimentary.
*e*¹. Palpi biarticulate, claws toothed or simple; terminal lobe of
 the ovipositor rounded, dorsally with a chitinous barbed
 process..... *Stefaniella* Kieff.

* Kieffer has proposed the name *Meunieriella* for species of *Lasioptera* without the dorsal group of hooks on the ovipositor. This, if adopted, would mean placing a considerable number of American forms now referred to *Lasioptera* into this new genus.

e'. Palpi uniarticulate.

f'. Mouth parts produced.

g'. Claws distinctly toothed.

h'. Ovipositor with a group of hooks on the basal half.

Baldratia Kieff.

h'. Ovipositor without hooks but with produced chitinous pectinate appendages, lobes broad.... Baldratiella Kieff.

g'. A very small basal tooth on the claws; ovipositor stout, curved, the distal portion slender, almost aciculate.

Baldratiola Kieff.

f'. Mouth parts not produced, normal; claws simple.

g'. Ovipositor aciculate..... Aplonyx Perez.

g'. Ovipositor with two diverging lobes..... Dibaldratia Kieff.

g'. Ovipositor obliquely truncate distad, with a row of hooks dorsad; head very small, well under the mesonotum.

Stefaniola Kieff.

b'. Mouth parts and thorax prolonged; antennal segments 10 to 13.

c'. Three long veins, the fifth forked..... Clinorrhyncha Loew.

c'. Four long veins, the fifth simple..... Ozirhynchus Rond.

a'. Third vein distinctly separated from costa and uniting therewith beyond the basal half.

b'. First antennal segment normal; not strongly produced; third vein strongly arched, it and the body not thickly clothed with scales.

Camptoneuromyia Felt.

b'. First antennal segment produced, with a length about three times its diameter, the third vein and the body thickly clothed with shining, frequently silvery, scales; ovipositor aciculate... Trotteria Kieff.

DASYNEURIARÆ

Key to the genera.

a'. Palpi quadriarticulate.

b'. Antennæ usually with 14 or more segments.

c'. Third vein uniting with the margin well beyond the apex of the wing.

d'. Fifteen antennal segments; wings hyaline; the ovipositor short.

e'. Claws normal, not strongly bent..... Baomyza Kieff.

e'. Claws bent almost at right angles, pulvilli rudimentary.

Stomatosema Kieff.

d'. Thirteen antennal segments; wings spotted; pulvilli almost half the length of the claws..... Hallomyia Kieff.

c'. Third vein uniting with costa near or at the apex of the wing.

d'. Costa without scales.

e'. Antennæ with 14 to more than 20 segments, usually with 18 or more.

f'. Third vein slightly curved, 19 antennal segments, the ovipositor short, the lobes orbicular..... Promikiola Kieff.

f'. Third vein nearly straight, the ovipositor usually produced.

g'. Ovipositor not chitinated apicad.

h'. Claws plainly unidentate, the tooth heavily chitinated.

Rhabdophaga Westw.

h'. Claws with a slightly chitinated trifid tooth.

Chortomyia Kieff.

- g*¹. Ovipositor chitinized apicad, bladeliike, the claws weakly toothed..... *Procystiphora* Felt.
- d*². Costa scaled.
- e*¹. Antennæ with 16 segments, claws shorter than the pulvilli, the ovipositor long..... *Riverella* Kieff.
- e*². Antennæ with 18 segments, claws longer than the pulvilli.
Trichoperrisia Kieff.
- e*³. Antennæ with 21 cylindrical segments, the legs scaled, the claws shorter than the pulvilli..... *Xyloperrisia* Kieff.
- e*⁴. Antennæ with 22 ovoid segments in the male, cylindrical in the female, claws shorter than the pulvilli.
Pernettyella Kieff.
- d*³. Third vein uniting with costa well before the apex of the wing, straight or curved cephalad and tapering but little.
- d*⁴. Claws of the anterior legs toothed, those of the mid and posterior legs simple.
- e*¹. Costa scaled, antennal segments 14, ovipositor short.
Phænolauthia Kieff.
- d*⁵. Claws on all legs toothed.
- e*¹. Wing veins distinctly scaled, the membrane more or less fuscous.
- f*¹. Body sparsely scaled, 14 cylindrical segments, the circumfila produced irregularly in certain males.... *Lasiopteryx* Steph.
- f*². Body scaled.
- g*¹. Claws of anterior legs, at least, toothed, more than twice the length of the pulvilli; 14 cylindrical antennal segments; ovipositor short..... *Lauthia* Kieff.
- g*². Claws of all the legs toothed, pulvilli rudimentary, ovipositor short..... *Cryptolauthia* Kieff.
- e*². Wing veins not distinctly scaled, the membrane hyaline.
- f*¹. Fifth vein forked, the female ovipositor long, sometimes longer than the body, circumfila not greatly produced.
Dasyneura Rond. (*Microperrisia* Kieff.).
- f*². Fifth vein simple, antennæ with 12 segments, the one circumfilum below the middle of the segment; pulvilli very small *Prowinnertzia* Kieff.
- b*¹. Antennæ with 10 to 12 or 13, rarely with 14 segments.
- c*¹. Thorax and abdomen plainly covered with scales; antennæ with 10 to 12 segments.
- d*¹. All the claws toothed; ovipositor long.
- e*¹. Twelve subglobular antennal segments. *Sphærolauthia* Kieff.
- e*². Ten to 12 subcylindrical antennal segments; ovipositor greatly produced..... *Ledomys* Kieff.
- d*². Claws of the anterior legs toothed, those of the mid and posterior legs simple, fifth vein simple, ovipositor short.
Brachyneurella Kieff.
- c*¹. Thorax and abdomen not plainly covered with scales.
- d*¹. Third vein uniting with costa near the apex of the wing.
- e*¹. Antennæ with 13 or 14 segments; terminal clasp segment of the male short, swollen; ovipositor subglobose, spined apically.
Cystiphora Kieff.
- e*². Antennæ with 13 or 14 segments; claws as long as the pulvilli; terminal clasp segment large..... *Geocrypta* Kieff.

- e¹. Antennæ with 12 segments, the flagellate ones sessile in both sexes.
 f¹. Terminal clasp segment large, greatly swollen. *Macrolabis* Kieff.
 f¹. Terminal clasp segment normal.
 g¹. Harpes not sickle-shaped or greatly produced. *Arnoldia* Kieff.
 g². Harpes sickle-shaped, greatly produced... *Harpomyia* Felt.
 d². Third vein uniting with costa well before the apex of the wing.
 e¹. Antennæ with 12 segments.
 f¹. Third vein strongly curved, uniting with costa at the distal fourth; flagellate antennal segments of the male stemmed. *Neuromyia* Felt.
 a². Palpi triarticulate.
 b¹. Claws unidentate; rarely bidentate.
 c¹. Antennæ with 16 to 18 segments, the flagellate ones stemmed in the male, sessile in the female, claws shorter than the pulvilli; male genitalia not unusual... *Dryomyia* Kieff.
 c². Antennæ with 18 segments, the flagellate ones sessile, the claws with a length one-half that of the pulvilli, terminal clasp segment very large... *Calopedila* Kieff.
 c³. Antennal segments 15, costa haired, legs scaled, ovipositor long. *Spartiomyia* Kieff.
 c⁴. Antennæ with 12 segments, terminal clasp segment slender, the dorsal and ventral plates deeply emarginate... *Rhizomyia* Kieff.
 b². Claws pectinate.
 c¹. Antennæ with 14 segments, the terminal clasp segment long, stout, the ovipositor short, the lobes broadly oval. *Ctenodactylomyia* Felt.
 a³. Palpi biarticulate.
 b¹. Antennal segments 14 to 18, the flagellate ones usually stemmed in both sexes... *Diarthronomyia* Felt.
 b². Antennal segments 12, the flagellate ones in the male stemmed. *Coccidomyia* Felt.
 a⁴. Palpi uniarticulate.
 b¹. Antennal segments 20, the flagellate ones stemmed in the male, sessile in the female, circumfila reticulate, the unidentate claws shorter than the pulvilli... *Soheuria* Kieff.
 b². Antennal segments 16 in the male, 18 in the female, the flagellate ones in the male stemmed, the trifid claws longer than the pulvilli. *Guarephila* Tav.

OLIGOTROPHIARIÆ

*Key to the genera **

- a¹. Palpi quadriarticulate.
 b¹. Third vein uniting with the margin well before the apex.
 c¹. Antennæ with 10 segments in the male, 9 in the female; claws very slender, curved almost at right angles; pulvilli rudimentary. *Properrisia* Kieff.
 c². Antennæ with 14 or more segments.

- d¹. Terminal clasp segment moderately large, pubescent, gradually tapering; ovipositor long, cylindric..... *Janetiella* Kieff.
- d². Terminal clasp segment large, elongate-ellipsoidal, the dorsal and ventral plates bilobed; ovipositor protractile.
Zygiobia Kieff.
- c¹. Antennæ with 13 segments.
- d¹. Female having the stems of the flagellate segments with a length two-thirds that of the segment, the terminal clasp segment slender..... *Nanolauthia* Kieff.
- b¹. Third vein uniting with the margin at or very near the apex.
- c¹. Antennæ with 14 segments, the genitalia and ovipositor about as in *Dasyneura*..... *Phytophaga* Rond.
- c¹. Antennæ with 16 to 20 segments.
- d¹. Third and fourth antennal segments not fused.
- e¹. Antennal segments in the male with a stem about two-thirds the length of the segment; terminal clasp segment rather slender, long, tapering gradually..... *Phegomyia* Kieff.
- e². Stem of the flagellate antennal segment as long as the basal enlargement, otherwise as in the preceding.
Cranciobia Kieff.
- d¹. Third and fourth antennal segments fused; antennæ with 18 or 19 segments, the stem of the flagellate segments with a length one-half to two-thirds that of the segment; terminal clasp segment slightly enlarged, gradually tapering, the dorsal and ventral plates deeply bilobed..... *Phegobia* Kieff.
- c¹. Antennæ with 20 to 24 segments.
- d¹. Antennal segments of male stemmed, those of female sessile; dorsal and ventral plates emarginate; ovipositor short, lobed.
Mikiola Kieff.
- a¹. Palpi triarticulate.
- b¹. Ovipositor distinctly chitinized.
- c¹. Ovipositor aciculate or cultriform; antennal segments 12 to 24.
Sackenomyia Felt.
- c¹. Ovipositor short, with a rounded, chitinized terminal plate; antennal segments 13..... *Phlyctidobia* Kieff.
- b¹. Ovipositor not chitinized.
- c¹. Terminal clasp segment of male subapical, the basal clasp segment with a broad, apical lobe..... *Luzonomyia* g. nov.
- c¹. Terminal clasp segment of male apical.
- d¹. Ovipositor almost truncate apically, without a distinct pocket; terminal clasp segment not large, the empodium twice as long as the claws, the third and fourth antennal segments not fused.
Oligotrophus Latr.
- c¹. Ovipositor with the terminal segment pocket-shaped, the empodium much longer or only a little longer than the claws.
- d¹. Intermediate whorl of the flagellate antennal segments in the male with two greatly produced hairs, the third and fourth antennal segments fused; terminal clasp segment very large, elongate, ellipsoidal..... *Mikomyia* Kieff.
- d¹. Whorls of the flagellate antennal segments otherwise.
- e¹. Basal clasp segment with a median, membranous, transparent prolongation attaining the tip of the ventral plate; terminal clasp segment large, pointed, ovoid.

- f*¹. Ventral plate deeply bilobed, third and fourth antennal segments fused in the male, the enlargement of the third a little longer than that of the fourth..... *Semudobia* Kieff.
- f*². Ventral plate entire, third and fourth segments not fused, the enlargement of the third twice as long as that of the fourth..... *Apiomyia* Kieff.
- e*¹. Basal clasp segment otherwise.
- f*¹. Stems of the flagellate antennal segments short in both sexes.
- g*¹. Antennæ with 22 to 25 segments (palpi are given as bi- or triarticulate); costa, subcosta, and third vein scaled.
Uleia Rübs.
- g*². Antennæ with 17 segments, the flagellate segments with 5 or 6 slightly looped circumfila; wings with a supernumerary vein..... *Lyclomyia* Kieff. and Jörg.
- f*². Stems of the flagellate antennal segments long in the male, very short or wanting in the female.
- g*¹. Third and fourth antennal segments fused; terminal clasp segment not large, gradually constricted, the larva with a breastbone..... *Blastomyia* Kieff.
- g*². Third and fourth antennal segments not fused; terminal clasp segment very large, swollen, the larva without a breastbone..... *Iteomyia* Kieff.
- a*¹. Palpi bi- or uniaarticulate.
- b*¹. Ovipositor chitinated, cultriform or more or less aciculate.
Sackenomyia Felt.
- b*². Ovipositor not distinctly chitinated.
- c*¹. Pulvilli nearly twice as long as the empodium.
- d*¹. Palpi biarticulate..... *Psectrosema* Kieff.
- d*². Palpi uniaarticulate..... *Walshomyia* Felt.
- c*². Pulvilli equal to the empodium; palpi uniaarticulate.
Isosandalum Kieff.
- c*³. Pulvilli distinctly shorter than the empodium.
- d*¹. Empodium as long as or longer than the claws.
- e*¹. Third flagellate antennal segment of the male large and with three circumfila, the other segments with two whorls.
Guignonia Kieff.
- e*². Third flagellate antennal segment not large and heavy and having no more circumfila than the others.
- f*¹. Terminal clasp segment large, swollen, or only slightly constricted distad; ovipositor subcylindric, greatly protractile; terminal segment strongly constricted, pocket-shaped.
- g*¹. Flagellate antennal segments with a long stem in both sexes; circumfila reticulate..... *Rhopalomyia* Rübs.
- g*². Flagellate antennal segments sessile or subsessile in the female; circumfila not reticulate.
- d*². Empodium twice as long the claws..... *Aroeuthomyia* Kieff.
- d*³. Empodium not longer or only a little longer than the claws; palpi uniaarticulate; larva without a breastbone.
Misopatha Kieff.*

* *Panteliola* Kieff., according to Kieffer, is separated from *Misopatha* by the biarticulate palpi.

ASPHONDYLIARIÆ

Key to the genera.*

- a¹. Ovipositor protractile, aciculate or nearly so, the terminal clasp segment of the male usually uni- or bidentate.
- b¹. Palpi quadriarticulate.
 - c¹. Flagellate antennal segments with long whorled hairs and two strongly sinuous and anastomosing circumfila, especially in the male.
 - d¹. Ovipositor aciculate, without lamellæ apicad; larval breastbone bidentate..... *Schizomyia* Kieff.
 - d². Ovipositor subaciculate, with two very small lamellæ apicad; larval breastbone unidentate..... *Kiefferia* Mik.
 - c². Flagellate antennal segments with short hairs, not whorled.
 - d¹. Flagellate antennal segments sessile, without an appreciable stem.
 - e¹. Claws much longer than the pulvilli; the basal segment of the ovipositor with rows of minute spinules.
 - Tetrasphondylia* Kieff.
 - e². Claws as long as the pulvilli; the first segment of the ovipositor finely striate, without spinules.
 - Parasphondylia* Kieff.
 - d². Flagellate antennal segments subsessile, with a stem about one-fourth the length of the basal enlargement; claws shorter than the pulvilli..... *Xenasphondylia* Felt.
 - b². Palpi bi- or triarticulate, rarely uniarticulate.
 - c¹. Third vein uniting with the margin near the apex of the wing.
 - d¹. Circumfila in the female consisting of two comparatively simple bands.
 - e¹. Terminal clasp segment of the male uni- or bidentate, not pectinate.
 - f¹. Subcostal cell normal, not opaque, the ovipositor with a lobed pouch proximad, not vesiculate basad.
 - Asphondylia* H. Loew.
(Syn. *Monasphondylia* Kieff.)
 - f². Subcostal cell opaque, the ovipositor with a globose, striate basal enlargement..... *Bruggmanniella* Tav.
 - e². Terminal clasp segment of the male pectinate.
 - f¹. Terminal clasp segment apical; ovipositor subaciculate, with submedian groups of hairs on the distal segment.
 - Proasphondylia* Felt.
 - f². Terminal clasp segment of the male subapical, the ovipositor probably as in *Schizomyia*..... *Bruggmannia* Tav.
 - d². Circumfila in the female forming five irregular, anastomosing bands; ovipositor as in *Asphondylia*..... *Oxasphondylia* Felt.
 - c². Third vein uniting with costa near the distal fourth.
 - d¹. Palpi triarticulate, the circumfila low, very irregular, terminal clasp segment slender, unidentate, dorsal and ventral plates deeply emarginate..... *Acroëtasis* Rübs.
 - b². Palpi uniarticulate.
 - c¹. Terminal clasp segment of the male subapical, conical.
 - Houardiella* Kieff.

* Revised from *Proc. U. S. Nat. Mus.* (1915), 48, 197, 98.

- c'. Terminal clasp segment of the male bidentate.
 d'. Subcostal cell remarkably broad, a rudimentary vein spur at the base of subcosta..... *Zalepidota* Rübs.
 d'. Subcostal cell not remarkably broad, no rudimentary vein spur at the base of subcosta; terminal clasp segment with greatly produced, tapering spurs or horns..... *Diceromyia* gen. nov.
 a'. Ovipositor exerted, apicad with lobes or triangular plates; terminal clasp segment of the male usually serrate apicad.
 b'. Palpi quadriarticulate.
 c'. Terminal clasp segment of the male subapical; third and fourth antennal segments not fused, the circumfila coarsely reticulate in the male, the pulvilli longer than the claws. *Polystepha* Kieff.
 c'. Terminal clasp segment of the male apical; third and fourth antennal segments fused, the circumfila usually with many fine reticulations in the male, the pulvilli usually shorter than the claws..... *Cincticornia* Felt.
 b'. Palpi triarticulate.
 c'. Terminal clasp segment of the male serrate apicad.
 d'. Circumfila of male coarse, very irregular, 4 or 5 transverse fila to a segment, the plates of the ovipositor triangular. *Feltomyia* Kieff.*
 d'. Circumfila of male fine, about 18 transverse fila to a segment, the terminal lobes of the ovipositor roundly quadrate. *Eocincticornia* Felt.
 c'. Terminal clasp segment of the male bidentate, subapical, the ovipositor conical..... *Daphnephila* Kieff.
 b'. Palpi uniarticulate; flagellate antennal segments subsessile; abdomen with caducous scales, the short ovipositor biarticulate. *Ozobia* Tav.

ITONIDIDINARIÆ

Skeleton key to the genera.

BIFILI

- a'. Flagellate antennal segments of the male all binodose (p. 310).
 a'. Some of the flagellate antennal segments of the male cylindrical (p. 311).

TRIFILI

- a'. Claws toothed on all the legs (p. 312).
 b'. Palpi quadriarticulate (p. 312).
 b'. Palpi triarticulate, uniarticulate (p. 314).
 a'. Claws on the anterior legs (and sometimes middle legs) toothed (p. 315).
 b'. Palpi quadriarticulate (p. 315).
 c'. Circumfila greatly produced (p. 315).
 c'. Circumfila regular (p. 315).
 b'. Palpi triarticulate (p. 316).
 a'. Claws all simple (p. 316).
 b'. Palpi quadriarticulate (p. 316).

* Judging from larval characters, this genus is closely related to and may possibly be a synonym of *Ulella* Rübsaamen.

- c'. Third vein before the apex (p. 316).
- c'. Third vein at the apex (p. 317).
- c'. Third vein beyond the apex (p. 317).
- d'. Circumfila irregular (p. 317).
- d'. Circumfila regular (p. 317).
- b'. Palpi triarticulate (p. 320).
- b'. Palpi biarticulate (p. 322).
- b'. Palpi uniarticulate (p. 323).

ITONIDIDINARIÆ

Key to the genera.

BIFILI

- a'. Flagellate antennal segments of the male all binodose.
- b'. Palpi quadriarticulate.
- c'. Claws on all legs toothed.
 - d'. Wings with greatly produced and broadly rounded areas posteriorly.
 - e'. Internal basal lobe of the basal clasp segment setose, the dorsal and ventral plates deeply emarginate, the lobes of the ventral plate very long, moderately narrow, the ovipositor very short, turned dorsad and not protractile. Indodiplosis Felt.
 - e'. Internal basal lobe of the basal clasp segment smooth, the dorsal and ventral plates broadly and slightly emarginate, the ovipositor with a length one-half that of the abdomen, protractile. Erosomyia Felt.
 - d'. Claws of anterior legs toothed.
 - d'. Wings normal, the posterior areas not greatly produced, the fifth antennal segment having the basal stem with a length about two and one-half times its diameter. Toxomyia Felt.
- c'. Claws all simple.
 - d'. Costa thickened basad to form a spindle-shaped enlargement.
 - e'. All of the flagellate antennal segments of the male binodose and with circumfila; ovipositor aciculate. Löwodiplosis Kieff.
 - d'. Costa not thickened basad.
 - e'. Wings of the male with the posterior area greatly produced and broadly rounded.
 - f'. Stems of the flagellate antennal segments of the male short, with a length about one-half the diameter, the harpes not strongly chitinizied. Loboapteromyia Felt.
 - f'. Stems of the flagellate antennal segments of the male with a length over twice their diameter, the harpes strongly chitinizied and convolute. Streptodiplosis Felt.
 - e'. Wings narrow, with a length at least three times the width, the ovipositor greatly produced, chitinizied. Thuraia Rübs.
 - e'. Wings normal, neither specially broadened nor narrowed.
 - f'. Costa thickly clothed with scales, the third vein uniting with the margin before the apex of the wing.
 - g'. The first antennal segment with a dorsal tooth, the wing membrane with narrow scales. Endaphis Kieff.

- g¹. The first antennal segment not toothed, the mesonotum with two lines of golden scales, the wings with smoky spots, iridescent..... *Lasiodiplosis* Kieff.
- f. Costa not scaled.
- g². Third vein uniting with the margin at the apex of the wing.
- h¹. Third vein interrupting the margin.
- i¹. Basal clasp segment not lobed; ovipositor long, slender; wings hyaline..... *Contarinia* Rond.
- i². As in *Contarinia*, except that the wings are spotted. *Stictodiplosis* Kieff.
- i³. Basal clasp segment with a triangular lobe basally; ovipositor short and with a semicircular ventral piece..... *Procontarinia* Kieff. and Cec.
- h². Third vein not interrupting the margin at its union with costa.
- i⁴. Ventral plate not longer than the dorsal, bilobed; terminal clasp segment large, pubescent; ovipositor long..... *Thecodiplosis* Kieff.
- i⁵. Ventral plate linear, much longer than the dorsal, emarginate; terminal clasp segment slender, smooth; ovipositor slightly produced..... *Sitodiplosis* Kieff.
- g³. Third vein uniting with the margin beyond the apex of the wing.
- h³. Terminal clasp segment of the male short, thick, pubescent; fourteenth antennal segment of the female with a large conical appendage..... *Stephodiplosis* Tav.
- h⁴. Terminal clasp segment moderately long, not pubescent; fourteenth antennal segment of the female without a conspicuous appendage..... *Syndiplosis* Rübs.
- α². Some flagellate antennal segments of the male cylindrical.
- b¹. Palpi quadriarticulate.
- c¹. All the flagellate antennal segments of the male cylindrical.
- d¹. Claws toothed, curved at almost right angles.
- e¹. Circumfila low; terminal clasp segment slender, the lobes of the dorsal plate rounded..... *Holobremia* Kieff.*
- d². Claws simple.
- e². Ventral plate a little longer than the dorsal plate; terminal clasp segment short, plainly swollen near the middle. *Geisenheyneria* Rübs.*
- e³. Ventral plate linear, emarginate apically, much longer than the dorsal plate; terminal clasp segment slender. *Monodiplosis* Rübs.*
- e⁴. Dorsal plate divided, the lobes triangular; ventral plate a little longer, linear, rounded; terminal clasp segment somewhat enlarged, slightly arched; ovipositor not produced. *Stroblophila* Kieff.
- c². Terminal flagellate antennal segments cylindric.
- d². Circumfila with a length one-half the setae, the stems shorter than the nodes, those of the two terminal segments wanting

* Location provisional.

- or almost wanting, the terminal clasp segment large, greatly swollen; ventral plate entire..... *Halodiplosis* Kieff.
- d'. Circumfila with short bows, the thirteenth and fourteenth segments with short stems; terminal clasp segment slender; ventral plate longer than the dorsal and deeply emarginate.
Ametrodiplosis Rübs.
- d'. Circumfila rudimentary.
- e'. Costa with a fusiform swelling basad, the basal stem of the fifth antennal segment with a length equal to its diameter; ventral plate much longer than the dorsal, much constricted and with a deep, straight incision, the lobes pointed; terminal clasp segment arched and long..... *Cyrtodiplosis* Kieff.
- e'. Costa not thickened basad, the basal stem of the fifth antennal segment with a length equal to the basal enlargement, the ventral plate sublinear, longer than the dorsal, narrowly incised and with two straight lobes; terminal clasp segment long, slender, curved..... *Anthodiplosis* Kieff.
- b'. Palpi triarticulate.
- c'. Basal clasp segment with a conspicuous triangular process apicad.
- d'. Terminal clasp segment subapical, the claws as long as the pulvilli..... *Dentibula* Felt.
- c'. Basal clasp segment without a process apicad.
- d'. Terminal clasp segment stout, with a length about three times its diameter; ventral plate almost truncate... *Myricomyia* Kieff.
- d'. Terminal clasp segment ellipsoidal, pubescent.
- e'. Ovipositor short, the length about equal to its diameter.
Zeuxidiplosis Kieff.
- e'. Ovipositor long, striate..... *Stenodiplosis* Reut.
- b'. Palpi biarticulate.
- c'. Third vein extending beyond the apex, the terminal clasp segment short, moderately stout, the dorsal plate short, deeply and triangularly emarginate..... *Anadiplosis* Tav.
- b'. Palpi uniaarticulate.
- c'. Third vein uniting with the margin well beyond the apex, the dorsal and ventral plates both long and emarginate.
Kronodiplosis g. nov.
- TRIFILI
- a'. Claws toothed on all the legs.
- b'. Palpi quadriarticulate.
- c'. Circumfila with one or more greatly produced bows or loops having a length five to ten times that of the enlargement and extending at approximately right angles to it.
- d'. Three well-developed circumfila on each flagellate antennal segment.
- e'. The three circumfila irregular, the pulvilli rudimentary, the ventral plate spatulate..... *Tribremia* Kieff.
- e'. Two circumfila irregular and one regular, the circumfilum on the basal enlargement with two greatly produced loops and the one on the distal enlargement with a shorter bow or loop.
- f'. Pulvilli a little shorter than the claws..... *Isobremia* Kieff.
- f'. Pulvilli rudimentary or wanting..... *Cryptobremia* Kieff.

- e*¹. One circumfilum irregular and with a bow or loop greatly produced, the other two circumfila regular, the style simple.
- f*¹. Ventral plate large, oval, as long as or a little longer than the dorsal; pulvilli equal to or longer than claws.
- Aphidoletes Kieff.
- d*². Two well-developed, irregular circumfila; basal circumfilum on the distal enlargement forming a low band; pulvilli small.
- e*¹. Legs clothed with hairs, the style not arched.
- f*¹. Flagellate antennal segments with the distal enlargement produced, the basal subglobose, the ventral plate linear, not emarginate and as long as the simple style... *Bremia* Rond.
- f*¹. Flagellate antennal segments with two subglobose enlargements, the ventral plate linear, emarginate and much shorter than the emarginate style..... *Homobremia* Kieff.
- e*². Legs clothed with scales, the style strongly arched basally.
- f*¹. Ventral plate shorter than the dorsal, linear and rounded distally..... *Lepidobremia* Kieff.
- c*¹. Circumfila nearly regular and without one or more greatly produced bows or loops.
- d*¹. Basal clasp segment with a basal lobe.
- e*¹. Flagellate antennal segments trinodose; terminal clasp segment much produced, plainly longer than the basal clasp segment; ovipositor short and with large, orbicular lobes.
- Youngomyia Felt.
- e*¹. Flagellate antennal segments binodose; terminal clasp segment not greatly produced, the ventral plate linear, a little longer than the dorsal plate; ovipositor moderately short and with long, densely haired lobes..... *Therodiplosis* Kieff.
- d*². Basal clasp segment without a distinct basal lobe.
- e*¹. Claws curved nearly at right angles.
- f*¹. Palpi long or moderately long.
- g*¹. Ventral plate linear, broadly emarginate; dorsal plate long, broad, triangularly emarginate, the circumfila slightly irregular, the style with filiform branches.
- Plesiobremia Kieff.
- g*². Ventral plate long, narrowly rounded apically; dorsal plate broad, deeply and broadly emarginate, the lobes moderately narrow apically..... *Dichodiplosis* Rübs.
- g*¹. Dorsal and ventral plates short, broad and deeply emarginate..... *Thomasia* Rübs.
- f*¹. Palpi short, the second antennal segment with a length one-half greater than its diameter..... *Collinia* Kieff.
- c*¹. Claws not strongly curved basad and therefore not forming almost a right angle.
- f*¹. Circumfila with numerous loops, about twenty.
- g*¹. Lobes of the ventral plate linear and parallel; ovipositor rather short..... *Geodiplosis* Kieff.
- f*¹. Circumfilar loops short, the hairs two to three times longer.
- g*¹. Lobes of the ventral plate short, broadly rounded; ovipositor short..... *Calodiplosis* Tav.
- f*¹. Circumfilar loops normally long and not excessively numerous.

- g¹. Cross vein well developed and nearly parallel with costa as in the Porricondylariæ..... *Lopesia* Rübs.*
- g². Cross vein not well developed and nearly parallel with costa as in the Porricondylariæ.
- h¹. Terminal clasp segment slender; lobes of the dorsal and ventral plates truncate; ovipositor short and with long, narrowly oval lobes..... *Resseliella* Seitzn.
- h². Terminal clasp segment stout; lobes of the dorsal and ventral plates narrowly rounded, the dorsal plate broadly, and the ventral plate deeply, emarginate; ovipositor long, with imperfectly divided lobes.
Harmandia Kieff.
- f⁴. Genera known only as females and presumably belonging here in the key.
- g¹. Ovipositor slightly protractile, the lobes long, curved, and with two or three longitudinal subventral rows of obtuse spines..... *Dicrodiplosis* Kieff.
- g¹. Ovipositor about half the length of the abdomen, the lobes with a length about six times the width; mouth parts prolonged..... *Delphodiplosis* Felt.
- g². Ovipositor moderately long, with a subcylindrical, dorsal part and a ventral oval plate with a narrowly triangular incision about one-fourth its length... *Schizodiplosis* Kieff.
- g¹. Ovipositor short, with three subcircular lobes, the ventral a little smaller than the two dorsal..... *Cacoplecus* Kieff.
- b¹. Palpi triarticulate.
- c¹. Flagellate antennal segments of female subcylindric.
- d¹. Male with three well-developed circumfila, though without greatly produced bows or loops.
- e¹. Circumfila with the loops short, thick and very numerous, each stem with a length less than its diameter; palpi moderately long; pulvilli rudimentary; dorsal and ventral plates long, the latter deeply emarginate and with relatively narrow lobes..... *Kalodiplosis* Felt.
- e². Circumfila with the loops only moderately numerous, not unusually thick, each stem with a length about twice its diameter, the palpi greatly reduced; dorsal and ventral plates very short, both emarginate.
- f¹. Ovipositor short, the terminal lobes narrowly oval, the dorsal and ventral plates short, emarginate.
Kamptodiplosis g. nov.
- f². Ovipositor about one-third the length of the abdomen, the basal portion long, stout, tapering, the lobes slender.
Male unknown..... *Helioidiplosis* g. nov.
- d². Male with two long circumfila, the second rudimentary, the loops not numerous, the pulvilli shorter than the claws, the dorsal and ventral plates deeply and roundly emarginate.
Roachadiplosis Tav.

* Included because of antennal structure although this insect belongs in the Porricondylariæ.

c'. Flagellate antennal segments of female, at least some, binodose.

d'. Female with two low circumfila on the cylindric distal enlargement of the flagellate antennal segments, none on the basal swelling; ovipositor about one-half the length of the body.
Ephormomyia Felt.

b'. Palpi uniarticulate.

c'. Cross vein well developed and nearly parallel with costa; claws quadridentate..... *Allodiplosis* Kieff. and Jörg.

c'. Cross vein not well developed and nearly parallel with costa; claws bidentate; circumfila very conspicuous and low as in *Asphondylia*..... *Frauenfeldtiella* Rübs.*

a'. Claws on the anterior legs and sometimes those of the middle legs toothed, those of the posterior legs simple.

b'. Palpi quadriarticulate.

c'. Circumfila with one or more greatly produced bows or loops having a length five to ten times that of the enlargement and extending at approximately right angles to it.

d'. Two irregular circumfila, one regular.

e'. Pulvilli nearly equal to the claws, the ventral plate elongate distad, subcaudate..... *Phænobremia* Kieff.

d'. One circumfilum irregular, two regular.

e'. Pulvilli one-half the length of the claws; ventral plate straight, linear and much longer than dorsal plate... *Monobremia* Kieff..

c'. Circumfila regular or nearly so and without greatly produced bows or loops.

d'. Basal clasp segment lobed.

e'. The lobe apical, setose or spinose; terminal clasp segment subapical..... *Lobodiplosis* Felt.

e'. The lobe subbasal, glabrous; terminal clasp segment short and bidentate..... *Antichiridium* Rübs.

e'. The lobe basal, setose or nearly glabrous.

f'. Ventral plate or harpes strongly chitinized.

Coquilletomyia Felt.

f'. Ventral plate and harpes as in *Lestodiplosis* and not chitinized..... *Feltiella* Rübs.

d'. Basal clasp segment not distinctly lobed.

e'. Terminal clasp segment subfusiform, distinctly dilated; harpes strongly chitinized and very complex..... *Karschomyia* Felt.

e'. Terminal clasp segment not as above.

f'. Claws curved nearly at right angles.

g'. Ventral plate greatly elongate and emarginate apicad; dorsal plate deeply cleft and triangularly emarginate.

Glinodiplosis Kieff.

g'. Ventral plate rounded apicad; dorsal plate deeply and narrowly divided..... *Oribremia* Kieff.

g'. Ventral plate broad, broadly and roundly emarginate, as long as the dorsal plate, the latter deeply and triangularly emarginate..... *Profeltiella* Kieff.

* Possibly belongs in the *Asphondyliaræ*.

- f. Claws not strongly curved and therefore not forming almost a right angle.
- g'. Ventral plate almost linear, straight and much longer than the dorsal plate..... *Acaroletes* Kieff.
- g". Ventral plate not greatly produced; lobes of the dorsal plate not divided, cleft or triangularly emarginate; female flagellate antennal segments with normal, low circumfila; ovipositor short..... *Mycodiplosis* Rübs.
- g". The female differs from *Mycodiplosis* in the two circumfila being produced as distinct and very short bows. Male unknown..... *Camptodiplosis* Kieff.*
- b'. Palpi triarticulate.†
- c'. Claws not bent at nearly right angles; three well-developed circumfila.
- d'. Terminal clasp segment not greatly produced; ventral plate short and broad..... *Diadiplosis* Felt.
- d". Terminal clasp segment greatly produced, with a length twice that of the basal clasp segment; ventral plate longer than the dorsal, moderately broad, rounded apically... *Xiphodiplosis* Felt.
- c". Claws bent at nearly right angles; two well-developed and one rudimentary circumfilum; ventral plate linear, roundly emarginate apically..... *Chelobremia* Kieff.
- a'. Claws simple or not toothed on any of the legs.
- b'. Palpi quadriarticulate.
- c'. The third vein uniting with the margin before the apex of the wing.
- d'. Wings hyaline.
- e'. Pulvilli as long or nearly as long as the claws.
- f'. Stems of the flagellate antennal segments mostly with a length less than the diameter; circumfila rather short; ventral plate deeply bilobed, not greatly produced.
Arthrocnodax Rübs. (*Feltodiplosis* Kieff.).
- f". Stems of the flagellate antennal segments probably rather long; circumfila moderately long; ventral plate much longer than dorsal plate, slender, greatly enlarged apicad, the distal portion with a width twice its breadth and slightly emarginate apicad..... *Microdiplosis* Tav.
- e". Pulvilli one-half the length of the claws or less.
- f'. Terminal clasp segment swollen and long-haired basally, distally slender and smooth; ovipositor not produced.
Silvestrina Kieff.
- f". Male unknown; female with the pulvilli hardly one-third the length of the sickle-shaped claws..... *Planodiplosis* Kieff.‡
- d'. Wings densely brown-haired, with clearer spots; costa with black scales as in *Lasioptera*.
- c'. Antennal hairs finely denticulate; thorax densely covered with yellow scales..... *Ohryodiplosis* Kieff.

* This genus, *Baeodiplosis* Kieff., and *Alethediplosis* Tav. are known only in the female and presumably fall here in the tabulation.

† *Epikhormomyia* Felt (see p. 315) may fall here in the key.

‡ Location provisional.

- o¹. Third vein uniting with costa at the apex of the wing.
- d¹. Claws as long as the pulvilli.
- e¹. Wings hyaline.
- f¹. Dorsal plate bilobed, the lobes rounded apically; ventral plate a little longer, straight, linear and slightly emarginate.
Endopsylla Meij.
- e². Wings bluish black, spotted with white.
- f¹. Dorsal and ventral plates bilobed, the lobes large and rounded apically..... Doxodiplosis Kieff.
- d¹. Claws plainly much longer than the pulvilli.
- e¹. Metatarsus almost one-half the length of the second tarsal segment; dorsal plate bilobed; ventral plate linear and rounded apicad; ovipositor short..... Plagiodiplosis Kieff.
- e². Metatarsus presumably less than one-half the length of the second tarsal segment; ovipositor as long as the body. Male unknown..... Orthodiplosis Kieff.
- c¹. Third vein uniting with costa beyond the apex of the wing.
- d¹. Circumfila irregular, one or more loops being greatly produced.
- e¹. Wings hyaline.
- f¹. Ventral plate much longer than the dorsal plate and rounded apically..... Hadrobremia Kieff.
- f¹. Ventral plate longer than the dorsal, bilobed.
Anabremia Kieff.
- e². Wings yellow with black spots.
- f¹. Legs spotted, thickly scaled; pulvilli nearly as long as the claws..... Plutodiplosis Kieff.
- d¹. Circumfila with short bows or wanting.
- e¹. Wings hyaline.
- f¹. Some of the flagellate antennal segments cylindric.
- g¹. Circumfila rudimentary or wanting; tenth to fourteenth segments cylindrical; harpes somewhat inflated.
Prodidiplosis Felt.
- g². Circumfila distinct though low, all the flagellate or only the distal antennal segments cylindrical; male antennæ about as long as the body; ovipositor short.
Caryomyia Felt.
- f². Flagellate antennal segments binodose in the male.
- g¹. Stems shorter than the enlargement, sometimes transverse.
- h¹. Stems very short, transverse, antennæ about as long as the body; ovipositor short..... Caryomyia Felt.
- h². Stems shorter than the enlargement; ovipositor long.
Macrodiplosis Kieff.
- f². Flagellate antennal segments probably binodose in the male, this sex being unknown.
- g¹. Ovipositor short, the lobes bearing, laterad or ventrad, rows of heavy, truncate or club-shaped processes.
Ctenodiplosis Kieff.
- g². Ovipositor short, the lobes without conspicuous processes.
- h¹. Pulvilli as long as the claws.
- i¹. Basal flagellate antennal segments of female cylindrical..... Eohormomyia Felt.

- i². Basal flagellate antennal segments of female plainly binodose..... *Androdiplosis* Felt.
- h². Pulvilli rudimentary..... *Diplocus* Kieff.
- e². Wings spotted.
- f¹. Terminal clasp segment very slender, subfiliform and smooth, the ovipositor short..... *Nanodiplosis* Kieff.
- d². Circumfila well developed and not conspicuously irregular, the loops mostly as long as or longer than the diameter of the enlargement.
- e¹. Claws bent at nearly right angles.
- f¹. Basal clasp segment lobed.
- g¹. Terminal clasp segment slender, curved, the ventral plate straight, pubescent..... *Octodiplosis* Giard.
- g². Terminal clasp segment as long as the basal clasp segment, enlarged and bilobed apicad; ventral plate almost linear and rounded apically..... *Trichodiplosis* Kieff.
- f². Basal clasp segment not lobed.
- g¹. Ventral plate long, slender, slightly expanded and roundly emarginate apicad; dorsal plate short, triangularly emarginate..... *Giardomyia* Felt.
- g¹. Ventral plate long, broad, very deeply and broadly emarginate; dorsal plate deeply and roundly emarginate.
Hyperdiplosis Felt.
- g². Ventral plate large, long and roundly excavated; dorsal plate bilobed, the lobes obliquely truncate.
Mycetodiplosis Kieff.
- g⁴. Male unknown, female with the ovipositor short, the pulvilli rudimentary..... *Chaetodiplosis* Kieff.*
- e². Claws not bent at right angles.
- f¹. Basal clasp segment lobed.
- g¹. The lobe apical.
- h¹. The lobe very long, curved, setose; terminal clasp segment swollen basad..... *Epidiplosis* Felt.
- h². The lobe triangular; terminal clasp segment short, greatly constricted near the middle and enormously swollen and recurved apicad..... *Metadiplosis* Felt.
- h³. The lobe small, densely haired; basal clasp segment with a length one-half that of the abdomen; circumfila each with twenty-six loops..... *Cœlodiplosis* Kieff.
- h⁴. The lobe membranous and extending from the basal clasp segment to the dorsal plate; terminal clasp segment with a similar membranous expansion.
Tristephanus Kieff.
- g². The lobe basal.
- h¹. The lobe obtuse.
- i¹. Ventral plate long, broad, broadly rounded; claws a little longer than the pulvilli..... *Orseoliella* Kieff.
- i². Ventral plate short, deeply bilobed; claws much longer than the pulvilli..... *Isodiplosis* Rübs.

* See also under *g*⁴ on page 320.

- k*². The lobe triangular.
- i*¹. Anterior legs with the underside of tibia and the first two tarsal segments with erect groups of hairs.
Lamprodiplosis Kieff.
- i*². Anterior legs without conspicuous groups of hairs.
- j*¹. Wings spotted..... Lestodiplosis Kieff.
- j*². Wings not spotted..... Coprodiplosis Kieff.
- f*². Basal clasp segment not conspicuously lobed.
- g*¹. Basal enlargement of the trinodose flagellate antennal segments with two circumfila, the distal with but one.
- h*¹. Ventral plate sublinear, tapering, rounded apicad and much longer than the dorsal plate.... Xenodiplosis Felt.
- g*². Anterior femur of the male plainly enlarged, it being three times the size of the tibia.
- h*¹. Terminal clasp segment as long as the basal; ovipositor long, with a conical, fleshy apex.... Eumerosema Kieff.
- g*². Antennal segments plainly trinodose.
- h*¹. Dorsal plate divided, its lobes orbicular.
Obolodiplosis Felt.
- g*⁴. Antennal segments short, thick, the stems transverse, the enlargements short, broad.
- h*¹. Circumfila fine, rather short, each with numerous (about 20) loops; genitalia moderately stout, dorsal and ventral plates bilobed..... Retinodiplosis Kieff.
- g*⁴. Without the striking characters listed under *g*¹ to *g*⁴.
- h*¹. Ventral plate linear, rounded apically.
- i*¹. Dorsal plate much shorter than the ventral plate, the lobes truncate..... Parallelodiplosis Rübs.
- i*². Dorsal plate longer than the ventral plate.
Blastodiplosis Kieff.
- h*². Ventral plate long, spatulate.
- i*¹. Dorsal plate moderately long, broad, deeply and triangularly emarginate, the lobes broad, obliquely and roundly emarginate..... Hypodiplosis Kieff.
- h*³. Ventral plate greatly produced and lobed.
- i*¹. Ventral plate broadly and roundly emarginate, the lobes diverging and broad..... Brachydiplosis Rübs.
- i*². Ventral plate triangularly emarginate, the lobes triangular, the ovipositor short..... Eudiplosis Tav.
- i*³. Ventral plate divided, the lobes very long and spatulate.
Styraxdiplosis Tav.
- h*⁴. Ventral plate broad and broadly or triangularly emarginate.
- i*². Lobes of the ventral plate linear and parallel.
- j*¹. The male with 14 and the female with 13 antennal segments; claws almost equal to the pulvilli; ovipositor long and filiform.
Delodiplosis Tav.
- j*². Male and female with 14 antennal segments; claws as long as the pulvilli; ovipositor stout and long.
Phyllodiplosis Kieff.

*i*². Lobes of the ventral plate not linear and parallel.

*j*¹. Dorsal plate deeply incised, the lobes narrowly rounded, the terminal clasp segment with a broadly chitinized, serrate margin..... *Paradiplosis* Felt.

*j*². Dorsal plate not incised or very narrowly emarginate.

*k*¹. Genitalia large, with a length one-fourth that of the abdomen; ventral-plate lobes slender and diverging; ovipositor short and with subtriangular lobes..... *Plesiodiplosis* Kieff.

*k*². Genitalia smaller, ovipositor not as described above.

*l*¹. Terminal clasp segment large, swollen near the middle and hairy; ovipositor long, with short hairs and short-haired lobes.

Plemeliella Seitz.

*l*². Terminal clasp segment with a length one-half that of the basal clasp segment and slightly tapering; ovipositor conical and with a length twice its basal diameter.. *Pachydiplosis* Kieff.

*l*³. Terminal clasp segment as long or nearly as long as the basal clasp segment and smooth; ovipositor moderately long and with lobes.

Itonida Meig.

*g*⁴. Genera known only as females. *

*h*¹. Cross vein present and well developed; pulvilli one-half as long as the claws; ovipositor small, produced.

Liebiola Kieff. and Jörg.†

*h*². Cross vein not well developed.

*i*¹. Ovipositor several times the length of the body; pulvilli less than one-half the length of the claws.

Xylodiplosis Kieff.

*i*². Ovipositor as long as the body, the latter covered with scales; pulvilli rudimentary..... *Lepidodiplosis* Kieff.

*i*³. Ovipositor short; pulvilli rudimentary.

Chetodiplosis Kieff.

*i*⁴. Ovipositor short, the terminal lobes slender and with a length nearly equal to a body segment.

Ouradiplosis Felt.

*b*². Palpi triarticulate.

*c*¹. Circumfila with short bows or loops, their length being one-half the diameter of the enlargement or less.

*d*¹. Thorax plainly extending over and concealing the head, at least to a considerable extent.

*c*¹. Male with 23 antennal segments, female with 14; the last or several of the distal segments in the male simple.

Hormomyia H. Lw.

*c*². Male with 36 antennal segments; flagellate segments all binodose and the stems short..... *Proshormomyia* Kieff.

* Location provisional.

† Probably referable to the *Porricondylaræ*.

- e³. Male and female with 14 antennal segments; flagellate segments of the female with 8 circumfila.... *Trishormomyia* Kieff.
- d². Thorax not produced over the head to a marked degree.
- e¹. Flagellate antennal segments of the male binodose.
- f¹. Basal clasp segment unarmed.
- g¹. Style not expanded apicad and with the sides not strongly chitinized.
- h¹. Third vein uniting with the margin well beyond the apex; wings long or rather long.
- i¹. Female with 3 circumfila on the flagellate antennal segments; ovipositor as long as the body.
Pseudhormomyia Kieff.
- i². Female with 2 circumfila on the flagellate antennal segments; ovipositor not long..... *Dyodiplosis* Rübs.
- h². Third vein uniting with the margin before or near the apex, wings rather short, broad; flagellate antennal segments of the male binodose and with very short stems or cylindrical; male antennæ about as long as the body; ovipositor short..... *Caryomyia* Felt.
- g². Style expanded apicad and with the sides strongly chitinized.
- h¹. Dorsal plate triangularly emarginate; ventral plate long, broad, broadly and roundly emarginate.
Massalongia Kieff.
- f². Basal clasp segment with a spine mesially.
- g¹. Pulvilli very small..... *Microplecus* Kieff.
- g². Pulvilli nearly as long as the claws..... *Holodiplosis* Kieff.
- e¹. Flagellate antennal segments of the male cylindrical, at least some.
- f¹. Third vein uniting with the margin near the apex; wings rather short, broad; male flagellate antennal segments binodose, with short stems or cylindrical; male antennæ about as long as the body; ovipositor short.
Caryomyia Felt.
- e². Circumfilar loops with a length equal to the diameter of the enlargement or longer.
- d¹. Wings hyaline.
- e¹. Basal clasp segment lobed.
- f¹. Genitalia very long, slender, the length equal to two-thirds that of the abdomen..... *Ischnodiplosis* Kieff.
- f². Genitalia moderate in size; ventral plate chitinized and denticulate..... *Odontodiplosis* Felt.
- e². Basal clasp segment not distinctly lobed.
- f¹. The third vein uniting with the margin before or at the apex of the wing.
- g¹. Dorsal half of each eye segregated from ventral half and uniting on vertex to form a third eye group.
Trisopsis Kieff.
- g². Eyes normal and not so widely separated.
- h¹. Claws a little longer than the pulvilli.
- i¹. Terminal clasp segment slender and smooth; dorsal

- and ventral plates bilobed; ovipositor short and with biarticulate lobes..... *Tricentarinia* Kieff.
- i². Ovipositor large, short and with obtuse lobes.
Atrichosema Kieff.*
- h². Claws small, much shorter than the pulvilli; ovipositor moderately long..... *Hydrodiplosis* Kieff.*
- f³. Third vein uniting with the margin beyond the apex of the wing.
- g¹. Fifth antennal segment of the female with a slight enlargement and a peculiar sensory organ near the middle.
Trissodiplosis Kieff.
- g². Second antennal segment prolonged ventrally as an obtuse lobe; ovipositor short and with two long lobes.
Acodiplosis Kieff.
- g³. Antennal segments normal, without unusual processes or organs.
- h¹. Dorsal plate deeply and triangularly emarginate.
- i¹. Ventral plate triangular, broadly and roundly emarginate; ovipositor long and the lobes long.
Taphodiplosis Kieff.
- i². Ventral plate linear, straight, not emarginate; ovipositor moderately long and the lobes long.
Haplodiplosis Rübs.†
- i³. Ventral plate linear, roundly emarginate; ovipositor aciculate and straight..... *Centrodiplosis* Kieff.
- h². Dorsal plate deeply and narrowly incised.
- i². Ventral plate broad and rounded; female unknown.
Adiplosis Felt.
- i³. Ventral plate narrowly emarginate; ovipositor moderately long, the lamellæ deeply bilobed.
Löwiola Kieff.
- h³. Genera provisionally placed here, the females only being known.
- i¹. Two circumfila, each with six to eight short bows; claws as long as the pulvilli..... *Plecophorus* Kieff.
- i². The two circumfila are flat or nearly so, otherwise as in *Plecophorus*..... *Aplecus* Kieff.
- d². Wings spotted.
- e¹. Third vein uniting with the margin beyond the apex of the wing; pulvilli nearly as long as the claws.
Stictobremia Kieff.
- e². Third vein uniting with the margin at the apex of the wing; cross vein is present as in the *Porricondylarix*.
Ampelosucta De Stef.‡
- b³. Palpi biarticulate.
- c¹. Wings hyaline.
- d¹. Circumfila short or only moderately long.
- e¹. Thorax not produced over the head.

* Only the female is known; location provisional.

† *Putoniella* Kieff. will probably fall here in the table.

‡ This genus may belong in the *Heteropezinæ*.

- f*¹. Circumfila apparently doubled in both sexes; third vein uniting with the margin at the apex of the wing; pulvilli as long as the claws; ovipositor short, with three lobes.
Dichrona Rübs.
- f*². Circumfila not apparently doubled, low and with eight to ten small bows; third vein uniting with the margin beyond the apex of the wing; ovipositor large, conical and with two long lobes; male unknown..... Perodiplosis Kieff.
- e*¹. Thorax produced over the head.
- f*¹. Circumfila not apparently doubled in the female; third vein uniting with the margin beyond the apex of the wing; pulvilli about one-half the length of the claws.
Dishormomyia Kieff.
- d*². Circumfila long or at least moderately long.
- e*¹. One or more basal antennal segments with an eccentric development or tooth.
- f*¹. Second antennal segment with a large lateral and oblique conical process; thorax produced as a cone in front but not covering the head..... Conodiplosis Kieff. and Jörg.
- f*². Second antennal segment prolonged ventrally as an obtuse lobe..... Neurodiplosis Kieff.
- f*³. The stem of the first flagellate antennal segment of the male with a lateral tooth near its middle; dorsal plate narrowly incised, ventral plate longer and rounded apicad.
Orscollia Kieff. and Mass.
- e*². Basal antennal segments without eccentric development or processes.
- f*¹. Dorsal plate broad, broadly and roundly emarginate; ventral plate broad, triangular and slightly emarginate; ovipositor short, with two large, oval lobes bearing transverse rows of obtuse spines apicad..... Braueriella Kieff.
- f*². Dorsal plate with the lobes obtusely truncate; ventral plate longer, linear, deeply and roundly emarginate; ovipositor short and with two lanceolate lobes..... Compsodiplosis Tav.
- f*³. Dorsal plate triangularly divided; ventral plate long, broad, roundly and slightly emarginate; style longer, rounded apically and the lateral margin strongly chitinized; ovipositor long, with two lanceolate lobes..... Massalongia Kieff.
- f*⁴. Male unknown.
- g*¹. Ovipositor short, with a chitinized falciform blade.
Jürgensenia Kieff.
- g*². Ovipositor moderately short, the two lobes elongate.
Courteia Kieff.
- c*¹. Wings marked with yellow and fuscous.
- d*¹. Fifth antennal segment with a stem one-half the length of the basal enlargement, which has a length four times its diameter; third and fourth segments free; third vein joins the margin beyond the apex of the wing; ovipositor short, the lobes angulate..... Scopodiplosis Felt.
- b*¹. Palpi unarticulate.
- c*¹. Circumfila apparently doubled in the male and female.
- d*¹. Pulvilli as long as the claws; ovipositor short and with three lobes..... Dichrona Rübs.

c'. Circumfila not apparently doubled in the male and female.

d'. Wings hyaline.

e'. Fourteen antennal segments in both sexes, the third and fourth not fused, the basal and distal enlargements globose and pyriform, respectively; dorsal and ventral plates deeply emarginate; ovipositor short, chitinous, falcate.

Monarthropalpus Rübs.

e'. Fourteen antennal segments, the fifth in the female with a stem one-third the length of the basal enlargement, which has a length two and one-half times its diameter; third and fourth antennal segments free; ovipositor stout, with a length one-half that of the abdomen, the distal part thickly clothed with long, silky hairs; male with moderately short circumfila, the fifth antennal segment having stems the length of which is twice the diameter; dorsal plate deeply, and ventral plate broadly, emarginate..... *Onodiplosis* Felt.

e'. Thirteen antennal segments in the female, the third and fourth fused, the basal and distal nodes globose and ovoid, respectively; dorsal and ventral plates bilobed; ovipositor short, chitinous, needlelike..... *Cystodiplosis* Kieff.

d'. Wings black and yellow marked.

e'. Basal and distal enlargement of the flagellate antennal segments globose and cylindrical, respectively; harpes forming a spinose, chitinous tube surrounding the style; ovipositor short, its lobes lanceolate..... *Astrodiplosis* Felt.

ILLUSTRATION

PLATE I

- FIG. 1. *Luzonomyia symphoremæ* Felt, g. et sp. nov.; male genitalia, diagrammatic, greatly enlarged. The shading indicates chitination. (Original.)
2. *Luzonomyia symphoremæ* Felt, g. et sp. nov.; side view of ovipositor, diagrammatic. (Original.)
3. *Dicceromyia vernoniæ* Felt, g. et sp. nov.; male genitalia, somewhat diagrammatic, greatly enlarged. Note in particular the greatly produced spines of the terminal clasp segment, dorsal and ventral plates not illustrated. The shading indicates chitination. (Original.)
4. *Kronodiplosis uichancoi* Felt, g. et sp. nov.; third antennal segment of male, showing setæ and circumfila; diagrammatic, greatly enlarged. (Original.)
5. *Kamptodiplosis reducta* Felt, g. et sp. nov.; fifth antennal segment of male, showing general shape, setæ, and circumfila; diagrammatic, greatly enlarged. (Original.)
6. *Kamptodiplosis reducta* Felt, g. et sp. nov.; male genitalia, diagrammatic, greatly enlarged. (Original.)
7. *Heliodiplosis spatholobi* Felt, g. et sp. nov.; side view of ovipositor of female, diagrammatic, greatly enlarged. The shading indicates chitination. (Original.)

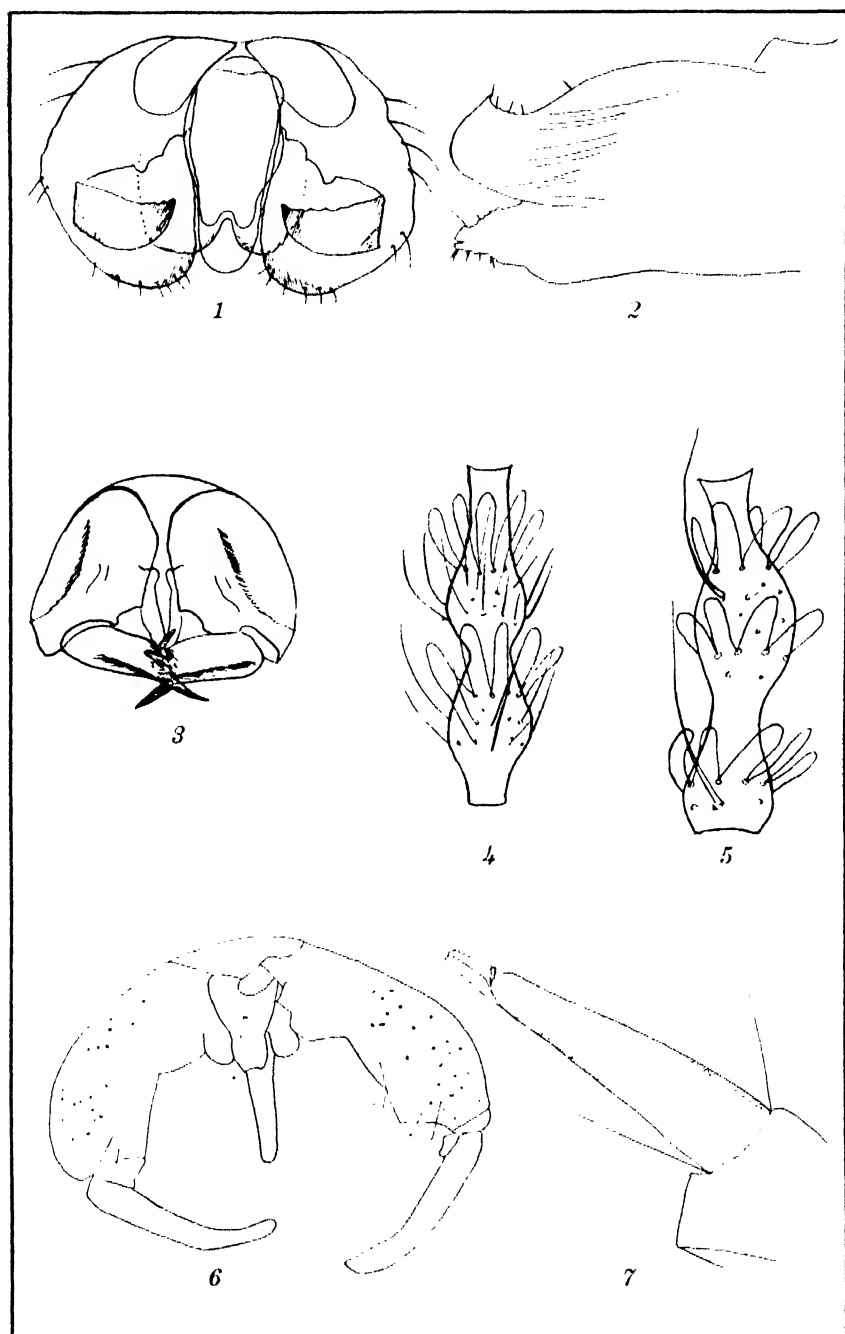


PLATE I. CHARACTERS OF NEW PHILIPPINE GALL MIDGES.

SOME NOTES ON THE BIRDS OF SOUTHERN PALAWAN AND ADJACENT ISLANDS

By JOHN T. ZIMMER

(Port Moresby, Papua)

In 1916 it was my good fortune to spend most of March and the first few days of April on Palawan, perhaps the most interesting island of the Philippine Archipelago, taken from a natural-history standpoint. Geographically, Palawan is very close to Borneo, and this proximity is reflected to a marked degree in the fauna of the region.

During the visit in question particular attention was paid to the bird life of the area, and a number of very interesting avian species were collected. Some of these are of particular value in view of their rarity everywhere or because of their infrequency of occurrence in the Philippine Islands or in the local fauna of Palawan. Some are new to that island and one is sufficiently distinct from the typical form, as found in other parts of the Archipelago, to warrant its description as new.

The bulk of the collection is not of exceptional importance otherwise than as the record of the captures may be of value in considering the distribution or relative abundance of the species concerned. Certain birds were seen which were not collected for one reason or another, but as all of these have been taken on Palawan by previous workers and as most of them are well known to me through acquaintance in other parts of the Philippines, there are few of them whose identity is at all doubtful. To make the account complete, all forms that were seen are listed whether collected or not, and the specimens taken are catalogued. These specimens are in my private collection at Lincoln, Nebraska, U. S. A.

I am indebted to Mr. R. C. McGregor, of the Philippine Bureau of Science at Manila, for freedom of access to the collection of that institution and for his assistance in the comparison of certain specimens, and to Mr. Frank Reid, formerly lieutenant-governor of southern Palawan, and his assistant Mr. Tobin for many courtesies extended during the period of investigations.

ITINERARY

Leaving Manila on the steamship *Panglima* I reached Puerto Princesa, the capital of Palawan, on March 4. That afternoon I

visited the forests back of the town and began the series of observations on which these notes are based. Leaving Puerto Princesa that night I arrived next morning at Brooke's Point which remained my headquarters for most of the remaining time.

Brooke's Point, or Point Sir James Brooke, is the name given to a sandy spit at the northern end of Ipolote Bay, a shallow harbor on the eastern coast of Palawan near its southern end. The adjoining region consists of a low sandy beach at the very edge of which begins a hardwood forest, overgrown with vines, creepers, and underbrush, extending inland for an average distance of a kilometer, there giving way to a grassy plain, marked with occasional thickets and scattered trees and bushes, which reaches to the mountains in the interior. Small streams and tidal swamps intersect the region with fringing vegetation of mangrove, nipa palms, or bamboo, the last occurring more commonly in the more open country. The whole area is nearly level until the mountains are reached. Outwardly the beach is fringed by coral reefs or sandbars or is open to the sea.

There is a small Moro settlement, Lara, at Brooke's Point and in the surrounding country may be found occasional huts of the Tagbanuas, sometimes with a greater or less amount of cultivated or cleared land nearby. These clearings and the native trails are the only open spaces of any great size in the forest, although certain parts of the latter are of a more open nature than others. It was along the trails that I did most of my collecting. Progress was difficult in the virgin jungle, and the birds there were not easy to approach. Moreover the species to be found there were usually near the trails in greater abundance. Consequently I found that the time spent in breaking a way through trackless areas could usually be more profitably spent in following a pathway that was already cleared.

I collected in the vicinity of Brooke's Point from March 5, the date of my arrival there, until the evening of March 17. On that date I embarked in a small launch with Governor Reid and Mr. Tobin, whose kindness made it possible for me to accompany them on an inspection trip around the southern end of the island and thus to visit a portion of the territory that otherwise I would not have seen.

March 18 we arrived at Sarong, a small village situated at the foot of a rocky bluff, which was overgrown with low jungle and extended along the shore. The principal feature of interest here was a broad coral reef, which was exposed at low tide and formed a feeding ground for numerous shore birds and

waders. We spent the day at this point and embarked again late the same evening.

March 19 we reached Dadagican at daylight and remained there until afternoon. This place consisted of a few houses grouped together on a small, low island, which was otherwise covered almost entirely by a coconut grove. Two species of herons, one species of kingfisher, a swallow, a swallow-shrike, a sunbird, a crow, and a lone sandpiper comprised the bird life of the island.

After leaving Dadagican we arrived at Bankalan at dusk, but as we departed again the same night I was unable to get any time in the forest at this place. The next morning, March 20, we reached Balabac Island. Our stay at Balabac was limited to one day. I found the country near the town of that name to consist mostly of forested hills of low elevation, without any level plains or open grassland.

March 21 we arrived at Dandelit where we spent the morning. This settlement is on the mainland of Palawan on the western coast and is situated in a small pocket at the foot of forested hills and cliffs which almost or quite meet the sea on either side. The jungle hereabouts is very dense, and as we put to sea again at noon, I was able, in the brief time available, to penetrate but a short distance into the tangle.

On the evening of March 21 we reached the settlement of Candauaga, which, also on the mainland, lies on a swampy plain at the mouth of a river, with a certain amount of good forest very near the shore and considerably more farther toward the mountains. This was my point farthest north along the western coast, as I made no effort to push on in that direction but remained at Candauaga for several days and explored the surrounding country.

The day after arrival I proceeded to the mouth of a second river a short distance to the south. At a small settlement nearby a boat and boatmen were secured, and I followed up the stream to the neighborhood of forests in the interior, returning that evening to Candauaga. Two days later I left most of my equipment in the launch, and accompanied by a Moro policeman from the Governor's party set out to cross the island to the eastern coast.

The first stage of the journey was made that night by boat, down the coast to the mouth of a broad river and up the current of the latter as far as our boat could go. There we embarked

in a little dugout and pushed on farther and when even this light craft grounded on the shallows we landed and made the rest of our way on foot. At a settlement not far from the landing guides were obtained for the mountain trails.

Leaving the settlement we took to the forest paths and crossed the mountain ridges until midafternoon, when we made camp by a little river high in the hills. The forest here was very dense, and birds apparently were scarce. Next day by an early start and by dint of strenuous hiking we managed to reach the settlement of Bonabona at dark. The way led first through mountain forests, then over grassy hillsides, and finally dropped to level, tree-dotted plains, alternating with swamps and marshland, until the sandy beach of the Sulu Sea was reached a short distance below our destination. From there we followed the beach to Bonabona.

I was unable to induce the natives of Bonabona to take me up the coast to Brooke's Point by boat, owing to heavy seas. Accordingly next morning, with fresh carriers, I took up the trail on foot and reached the desired locality by nightfall. The trail embraced seashore, grassed plains, open woods, mangrove swamps, broad river valleys, some of which were dry, and heavy forest, all practically at sea level.

On March 28, the day following arrival, I resumed operations at Brooke's Point and continued them until April 3, which was marked by the appearance of the steamer on which I planned to leave the locality. On the voyage up the coast between Brooke's Point and Puerto Princesa, the vessel stopped at Calatugas on April 4 and 5 and at Tagbariri on April 6 and 7. I went ashore at both places and found much the same type of country at both—a low sandy beach with forest in the rear. Beyond Tagbariri other matters occupied my attention and no further detailed notes were taken.

MEGAPODIIDÆ

Megapodius cumingi Dillwyn.

Occasionally I saw megapodes, usually in pairs, along the shore near Brooke's Point. The birds were very wary and when alarmed took a running flight into the nearby jungle, uttering a loud cackling note. I flushed one pair from the bottom of a burrow, which had been scratched for a depth of about one meter below the roots of an old stump. The bulky mounds constructed by the species were numerous in the woods bordering the beach.

PHASIANIDÆ

Gallus gallus (Linnæus).

Jungle fowls were not rare in the forest but were more often heard than seen. One of the earliest sounds of the morning, before the rest of the forest seemed fully awake, was the crowing of the wild roosters back in the jungle. A flock of these birds, composed of a cock and six hens, remained in a certain part of the woods near the beach trail about two kilometers below Brooke's Point and was frequently encountered at that place. Other records are from Bonabona, Candauaga, Puerto Princesa, and Balabac.

TURNICIDÆ

Turnix fasciata (Temminck).

This button quail was often flushed from the grass, rather abundantly on the open plains near Brooke's Point and Bonabona. It frequently lay close when discovered or skulked silently through the grass and was by no means easy to see unless it took wing. Localities for this species are Brooke's Point, Sarong, Candauaga, Tagbariri, Bonabona, and Balabac. One specimen was taken at Tagbariri.

TRERONIDÆ

Treron nipalensis (Hodgson).

Thick-billed green pigeons were abundant in the neighborhood of the fruit trees in the forest. While moving about through the foliage they were easy to locate, but when alarmed they would stop and sit motionless, whereupon they seemingly melted into their leafy surroundings. I frequently collected other sorts of birds from various trees favored by the present species and often, at the report of the gun, saw the branches disgorge a score of these pigeons of whose presence I was entirely unaware until the sudden uproar and the charge of shot tearing through the foliage drove the hidden occupants from their retreat. Although most often assembling in flocks, these pigeons not infrequently went about in pairs, more rarely alone, and it is possible that the flocks at this time consisted of a number of pairs. My records are from Brooke's Point, Sarong, Dandelit, Candauaga, Bonabona, Calatugas, Tagbariri, and Balabac. Specimens were taken at Brooke's Point.

Osmotreron vernans (Linnæus).

Pink-necked green pigeons were abundant in the trees about the open and not uncommon at the edge of the forest. The

species was breeding at this time, and I often saw flocks of twenty or thirty males without one of the opposite sex. On March 17 I discovered a nest in one of the scattered trees on the grassland beyond the forest at Brooke's Point. The female was on the nest and remained there until I started to ascend the tree, when she left with a sudden rush and took a long round-about flight, which brought her up again to the top of a nearby tree within sight of her nest, where she remained until I left the neighborhood. The nest was a loosely constructed platform about 13 centimeters in diameter and was placed some 4 meters above ground. The eggs, which were distinctly visible from the ground through the bottom of the nest, were pure white, regularly elliptical, and measured 28 by 22 and 26 by 21 millimeters. Both were fresh. A second nest was discovered at Calatugas on April 5, similar to the first but only 1.2 meters from the ground. Unfortunately the eggs from the latter were broken before measurements could be taken. I found *O. vernans* at Brooke's Point, Candauaga, Bonabona, Calatugas, Tagbariri, and Puerto Princesa. The species is well distributed through the Philippines.

Muscadivores palawanensis (Blasius).

The Palawan imperial pigeons were common throughout the region wherever there was forest. Their deep "ah-hoo-oo" and guttural "kr'-r-r-r-r, kr'-r-r-r-r, kr'-r-r-r-r" were familiar sounds along the trails through the deep woods, although the birds became silent or took flight when aware of being approached. Since they usually chose the upper branches of the tall trees for their feeding grounds, it was not always easy to catch sight of them, even when they were noisy and moving about, nor was their collecting easy, for their perch was sometimes nearer rifle range than shotgun range. My records for this bird are from all points except Dadagican. Specimens are from Brooke's Point.

Myristicivora bicolor (Scopoli).

I saw a single nutmeg pigeon at Brooke's Point on March 12 but was unable to get within shotgun range of it owing to its wariness. This species was reported to me as being common on the west coast of Palawan near the settlement of Alfonso XIII, but I was unable to verify this for myself. Previous observers have recorded the species from other localities in Palawan.

PERISTERIDÆ

Spilopelia tigrina (Temminck and Knip).

On several occasions in more or less open places along the trails I encountered the Malay spotted dove in pairs or in groups of four and five. It was not an abundant species. Usually the birds were on the ground; sometimes at low elevations in the scrub thicket. I have records from Brooke's Point, Bonabona, Candauaga, Tagbariri, and Calatugas. One specimen was taken at the first mentioned locality.

Chalcophaps indica (Linnæus).

I often saw the Indian bronze-winged dove in the forest, always singly as I have found it elsewhere. This species is always wary, is very swift on the wing, and darts through the woods at a rate of speed that would seem to threaten collision with tree trunks and other obstacles. In a dark forest it seems but a moving shadow. My notes record the species from Brooke's Point, Dandelit, Candauaga, Bonabona, Puerto Princesa, and Balabac.

Caloenas nicobarica (Linnæus).

On March 15 I flushed two Nicobar pigeons in the deep forest at Brooke's Point but did not get the specimens, nor did I find the species at other times. They were reported to me as occurring commonly at Balabac and on the west coast of Palawan, but I did not see them at either place. Locally they were known as *siete colores*.

CHARADRIIDÆ

Arenaria interpres (Linnæus).

A single turnstone was seen on the coral reef at Brooke's Point on April 1. I was unarmed at the time, and when I returned with a gun the bird had disappeared.

Squatarola squatarola (Linnæus).

On April 1 I found a flock of black-bellied plovers at Brooke's Point and secured one of the lot. This was the only occasion that I met with the species in Palawan.

Ochthodromus geoffroyi (Wagler).

Plovers of the genus *Ochthodromus* were occasionally seen along the beach at Brooke's Point and Sarong. The single specimen that I secured at Brooke's Point is *O. geoffroyi* to which species possibly all the individuals that I saw belong, although

both *O. mongolus* and *O. veredus* have been taken in Palawan by previous collectors.

Numenius variegatus (Scopoli).

At Sarong on March 18 I saw a number of curlews on the coral reef at low tide, but they were exceedingly wary, and I had difficulty in securing specimens. The reef was broad and the curlews kept to the seaward edge of it in company with numerous individuals of *Demigretta sacra* and *Bubulcus coromandus*, some of which always took alarm, if the curlews did not, and startled the whole flock into hasty flight, the result being that whenever I attempted to cross the intervening space of reef the entire company would be off and away long before I got within range. By taking a stand on the beach and waiting for fifteen or twenty minutes, however, I succeeded in so disarming the suspicion of the birds that they worked their way gradually into gunshot range and I was able to secure two of them before they got away again. Both individuals were females, and both were remarkable for their unusually long bills which measured 90 and 91.5 millimeters along the culmen, respectively, about the maximum for *N. variegatus*.

Actitis hypoleucos (Linnæus).

This common sandpiper, the only representative of its genus in the Islands, was frequently seen along the seashore or river banks or at the edges of forest pools. Although numerous it was very solitary in habits. I found it at all points visited.

[*Pisobia* sp?

There were one or two small sandpipers belonging to this group found occasionally along the reefs at low tide in the vicinity of Brooke's Point, while others were seen at Sarong although no specimens were taken. Most of them were probably *P. ruficollis* (Pallas), which is common and widely distributed in the Islands, but some of them may have belonged to the rarer *P. damacensis* Horsfield. Both forms have been recorded from Palawan.]

CEDICNEMIDÆ

Orthorhamphus magnirostris (Vieillot).

At Tagbariri on April 6 I saw an Australian stone plover alone on a reef which was cut off from the mainland by a channel of deep water. It was impossible to get within range and an experimental shot only had the effect of driving the bird to the far side of the reef, whence it shortly took flight seaward for a more distant islet.

ARDEIDÆ

Pyrroherodia manilensis (Meyen).

On March 22 as I was floating down a river near Candauaga, a heron of the present species flapped lazily across the river in front of the canoe and disappeared in the mangroves that lined either bank of the stream. Another individual was seen on the reefs at Brooke's Point after I returned to that locality. These were the only instances of the occurrence of this species that came to my notice.

Demigretta sacra (Gmelin).

I saw the first blue reef heron at Brooke's Point on the afternoon of March 17. It had certainly not been in the neighborhood before that date. The following day at Sarong, farther south, the species was common and still later it was seen at Dadagican, Candauaga, and Bonabona. These are apparently the first records for Palawan, although *D. sacra* has been found on Cuyo and Balabac, and therefore its occurrence on the former island is not entirely unexpected. Specimens were taken at Brooke's Point and Sarong.

Bubulcus coromandus (Boddaert).

Indian cattle egrets were present at Brooke's Point, Sarong, Dadagican, Candauaga, Bonabona, and Tagbariri. They were not abundant at any of these places.

FALCONIDÆ

Accipiter virgatus (Temminck).

At Calatugas on April 4 I saw a small hawk, which I am certain belonged to the present species, although unfortunately I was unable to secure the specimen. I refer it to *A. virgatus* because that species, but none of its congeners, has been recorded previously from Palawan.

Spilornis bacha (Daudin).

While crossing the mountains in the interior of Palawan on March 26 I saw a serpent eagle circling about, which came near enough to permit the recognition of its characteristic markings but not near enough for a shot. Palawan birds are referable to *S. bacha*.

Buteo indicus (Gmelin).

The tic-wee buzzard was not uncommon in the more open country back of Brooke's Point and was noted also at Calatugas, Bonabona, Puerto Princesa, and Candauaga. If not soaring

overhead it was perched on some exposed position where it kept close watch over the surrounding country.

CACATUIDÆ

Cacatua hæmatropygia (P. L. S. Müller).

Cockatoos were abundant throughout the forest at all points visited except Dadagican. Owing to their active habits, their conspicuous plumage, and their noisy, screaming voices they were in evidence somehow most of the time. A certain dap-dap, or coral, tree (*Erythrina* sp.?) in the forest near the settlement at Brooke's Point was a favorite resort of these birds, and there they frequently congregated in some numbers. Most of the cockatoos had their ventral plumage stained brown with some gummy vegetable substance, giving them a very dirty appearance.

On May 4 at Calatugas I saw a pair of cockatoos at a hole near the top of a dead tree about 18 meters from the ground. It was the only suggestion of nesting conditions that I noticed.

PSITTACIDÆ

Prioniturus cyaneiceps Sharpe.

Blue racket-tailed parrakeets were probably not uncommon at Brooke's Point and elsewhere, but as they were neither very noisy nor very conspicuously garbed they were not often seen. Their note was a sort of harsh, grating squeak, which I heard a number of times before I succeeded in associating it with the parrakeets, but which after I had learned it often furnished me with the first intimation that these birds were in the vicinity. They easily concealed themselves in the foliage by the simple process of sitting motionless, though they might be in plain sight. Some of the individuals were in good plumage; others had the feathers badly abraded, especially the terminal rackets of the tail. Brooke's Point and Candauaga are the only localities where these birds were seen. Specimens were taken at Brooke's Point.

Tanygnathus lucionensis (Linnæus).

The Philippine green parrot was very abundant in the neighborhood of Brooke's Point. It congregated in flocks of greater or less size, which frequented the forest, often in company with the cockatoos whose noisiness was, if anything, excelled by the vociferation of the present species. Like the cockatoos these parrots were wary and alert, and although they might remain in apparent indifference to the approach of an observer they

were well aware of the narrowing distance and at the proper time departed with unceremonious speed. They often flew overhead clear above the forest, screaming loudly. My observations of *T. lucionensis* were confined to Brooke's Point, Candauaga, and Calatugas. Specimens were taken at Brooke's Point.

CORACIIDÆ

Eurystomus orientalis (Linnæus).

At Brooke's Point and Tagbariri where the edge of the forest adjoined the open country or in the neighborhood of the clearings, a few broad-billed rollers were observed. Even at these places they were not common.

ALCEDINIDÆ

Alcedo bengalensis Gmelin.

The usually common and widely distributed Asiatic kingfisher was not so common in southern Palawan as I have seen it elsewhere, but it was occasionally noted about the mangrove swamps and river banks. Records are from Brooke's Point, Sarong, Candauaga, Bonabona, Calatugas, Tagbariri, and Balabac.

Alcedo meninting Horsfield.

The Malayan kingfisher was much rarer in the region visited than its congener, the preceding species. I saw only two individuals, one at Brooke's Point on March 15 and another near Candauaga on March 22. Both were along the mangrove-bordered banks of rivers.

Halcyon coromandus (Latham).

Two ruddy kingfishers were noted on March 26 in the mountains behind Bonabona, but they escaped in the thick jungle. No others were seen.

Oberholser¹ has recently separated the Philippine form of this species under the subspecific name *ochrothorectis*. Since the Bornean *minor* has been taken in Tawitawi it seems probable that it would also occur in Palawan; therefore I will not attempt to place subspecifically the birds that I saw. In Oberholser's paper the generic name *Entomothera* is used for this species, not *Halcyon*. The characters on which the separation is based (conformation of bill, comparative length of primaries, and relative measurements of bill and wing) are such that most of the Philippine species of *Halcyon* could each be isolated there-

¹ *Proc. U. S. Nat. Mus.* (1915), 43, 652.

upon with equal facility. I have, moreover, specimens of the present species which do not agree well with the distinctive characters given for *ochrothorectis*. I have preferred, therefore, to follow the nomenclature used by Sharpe and followed by McGregor.

Halcyon pileatus (Boddaert).

On March 15 at Brooke's Point I saw a solitary black-capped kingfisher at the edge of a mangrove swamp into which the bird retreated at my approach. As progress in the swamp was infinitely more difficult for me than for the bird, it soon escaped entirely out of sight. At Balabac on March 20 I saw another of the species along a stream among the wooded hills, and on March 22 at Candauaga I saw a third at the edge of a nipa swamp bordering one of the rivers. I succeeded in getting none of them.

Halcyon chloris (Boddaert).

White-collared kingfishers were the commonest of all of their family in the region. More, perhaps, were noted in the neighborhood of human habitations than in the remote districts, possibly because the birds, like man, favored more or less cleared areas. A pair inhabited the tiny grove of coconuts behind the governor's house at Brooke's Point, where they were in evidence every day, for the most part fearless at my approach.

BUCEROTIDÆ

Gymnolæmus lemprieri (Sharpe).

The Palawan hornbill was a very interesting bird of which I saw rather less than I desired. It seemed to be a silent creature most of the time, not given much to vocal expression, but its voice when used was loud and raucous although less resonant and powerful than that of the larger *Hydrocorax* of other of the Philippine Islands. These hornbills were wary, though when startled they did not always seek distant forest depths but often settled again in trees hardly out of sight of the perches they had just abandoned. There, however, they remained alert and watchful, prepared to seek further safety in flight perhaps more readily than the first time they had been disturbed. They were fond of a certain large-seeded fruit, which was common in the forest, and upon which they were most often seen feeding in company with various of the pigeons. Occasionally solitary

individuals were seen, but flocks were much more common. I was able to get but a single specimen, a female, with bill much less prominently developed than that possessed by the males.

CAPRIMULGIDÆ

Caprimulgus macrurus macrurus Horsfield.

Nightjars were rather common at Brooke's Point where I often heard them in the evening along the beach or in the nearby clearings, uttering their weird "owk-owk," then after a little pause, "owk-owk" again, and so on monotonously well into the night, each call, perhaps, answered by other birds nearby. Occasionally I flushed them at the edge of the forest during the daytime and one specimen I took in a bamboo thicket along a stream in more or less open country. In daylight they were silent and stationary unless disturbed; only at night were they really active. Sometimes when I was not busy after dark, I would fasten a small acetylene searchlight to my hat and, armed with gun and bag, would go out jack-lighting for these birds and for other night wanderers of the forest. Guided by the sound of the monotonous note of the nightjars I could get within range of one of them before it took alarm, the light from the lamp producing an answering gleam from the bird's large eye, which would shine with a reddish glow in a single spot of fire that formed an excellent target. At times, before I could shoot, or if I continued to approach, the spot of flame would wink out and in a moment or two I would hear the interrupted monotone taken up at a different point and I would know that my bird had moved to a safer distance. If the night were brilliantly moonlit I might see the shadowy flutter of wings as the creature left its post or might even see it resting wherever it might be. Once or twice on such occasions I have thought, though I could never be certain of it, that the nightjars were then not the horizontal, crouching forms that they were in daytime, but that they sat more alert, more erect. I know that they often forsook terrestrial haunts, for I could see them perched on the tops of small bushes about a meter above ground.

I saw and collected birds only at Brooke's Point, but I heard others, some of which were undoubtedly the same form as the present one, at Candauaga and Tagbariri. *Caprimulgus manilensis* and *C. jotaka* have both been collected in Palawan, but all of my specimens are referable to *C. macrurus* and to the typical variety of that species.

CUCULIDÆ

Cacomantis merulinus (Scopoli).

The rufous-bellied cuckoo was quite rare in the localities visited. A single female was seen and collected at Brooke's Point on March 14.

Chalcococcyx xanthorhynchus (Horsfield).

The beautiful little violet cuckoo was not common. I found it only thrice. All three birds were rather high up in tall trees in the forest at Brooke's Point, one at such a height that when I collected it I did not know what I had taken until it reached the ground. All three birds were males.

Eudynamys mindanensis (Linnæus).

Koels were heard not uncommonly in the forest, but owing to their secretive habits they were seldom seen, and then usually as they were slipping out of sight into some tangle of vines and creepers. Their song, if such it may be called, was a weird performance, especially if heard at the dead of night in the heart of the jungle. Beginning with a measured "ba-how', ba-how', ba-how'," the syllables would be repeated in a crescendo of rising pitch and acceleration until the last notes were given in a frantic "how-how-how-how" that was broken off abruptly, leaving a silence which seemed the more intense because of the preceding clamor.

Two species, *E. honorata* and the present form, have been recorded from Palawan but two specimens, male and female, which I secured at Brooke's Point are both referable to *E. mindanensis*. I noted koels, whichever form they may have been, at Brooke's Point, Tagbariri, Candauga, Calatugas, and Puerto Princesa.

Centropus javanicus (Dumont).

Coucals were seen at Brooke's Point, Bonabona, and Candauga in the areas of tall grass. They were not rare, but like the koels they were heard more often than they were seen. I saw only *C. javanicus*, although *C. sinensis* is recorded from the island.

Dryococcyx harringtoni Sharpe.

Harrington's cuckoo was found in the more jungly parts of the forest, usually skulking amongst the foliage of the lower growths and the vine-tangled thickets. In spite of its bright colors it is not a conspicuous bird. I found it in the lowland forest as well as on the wooded mountain ridges. Records and

specimens are from Brooke's Point, Candauaga, Bonabona, and Balabac, and records only from Sarong and Tagbariri.

PICIDÆ

Tiga everetti Tweeddale.

Everett's three-toed woodpecker was moderately common and well distributed over the region. I found it in the deeper parts of the forest and sometimes in the thicker bits of scattered woodland on the plains. My records are from all points visited except Dadagican. Specimens are from Brooke's Point.

Thriponax hargitti Sharpe.

I found Hargitt's black woodpecker to be rare and shy in the vicinity of Brooke's Point; at the other localities I did not find it at all. It is possible that there was only a single pair near Brooke's Point. I rarely saw more than one bird, which was very restless and shy, continually moving from place to place in the forest. I never got within range of it until March 17. On that day, while crossing a swampy section of woods, I happened to take shelter from a sudden downpour of rain on the leeward side of a large tree whose buttressed roots furnished ample protection from the shower. While there I heard the call note of the species with which I had become familiar, and on looking out from my retreat I saw one of the woodpeckers on a tall, dead tree nearby, just within range. I dropped it from where I stood, retrieved it, and returned to my shelter. Again I heard the unmistakable note and looked out just in time to see a second bird edging out of sight around the dead tree trunk. I circled the bole in the opposite direction, but the woodpecker had evidently taken flight when out of my sight around the trunk, and I did not get it. It was the last time I saw the species in Palawan. My specimen was a male. I have carefully compared this specimen with the series from Masbate in the collection of the Bureau of Science with which it seems to agree perfectly. Palawan is the type locality of this species but as has been pointed out by other workers it is strange that the Masbate bird is conspecific, in the case of the present genus.

PITTIDÆ

Pitta propinqua (Sharpe).

I searched for the Palawan pitta the whole time that I remained in the region, but it was near the end of my investigations before I found it. On March 31 I found a lone individual in the heart of a bit of jungle, quite close to the settlement at

Brooke's Point. It would have been overlooked entirely had it not taken flight, for it was silent and well hidden in a particularly dense thicket not in my line of travel. The specimen was collected and proved to be a male.

Pitta atricapilla Lesson.

The black-headed pitta was occasionally seen and frequently heard in the forest, especially in those parts overgrown with underbrush. I found it at Brooke's Point, Sarong, Candauaga, Balabac, and along the trail across the mountains between the east and west coasts. Specimens were taken at Brooke's Point and Balabac.

Most of the pittas, of this and related species, which I have found have been on the ground or at most a few feet above it, on fallen tree trunks and the like. One of the present species that I saw at Brooke's Point, however, proved an exception to the general rule. I heard this bird distinctly and had no difficulty in reaching its approximate neighborhood. Once there, however, I was puzzled to get the bird in sight, although it continued its explosive "wow ha" apparently only a few yards away. Since the ground was more or less open thereabouts I was able to scan carefully every bit of it, but without result until I happened to glance upwards when, to my surprise, I saw the pitta on a projecting limb of a tree twenty feet above ground.

HIRUNDINIDÆ

Hirundo javanica Sparrman.

The Asiatic swallow was the only member of its family that I noted in Palawan. I saw it at all points visited, where it was present in small numbers, usually near the settlements.

MUSCICAPIDÆ

Hemichelidon griseosticta Swinhoe.

Two gray-spotted flycatchers were seen in Palawan, one at Candauaga and the other at Brooke's Point, and both were secured. The Candauaga specimen differs somewhat from the other and from all other specimens of the species that I possess. The brown streaks on the breast and sides occupy the major portions of their respective feathers, the white of the underparts is tinged with buff, the edging of the tertials and greater wing coverts is deep buff, while the under wing coverts are more tawny than is usual. The base of the bill is yellowish, and the entire appearance suggests the description of *H. sibirica*,

but the bird shows signs of immaturity and is in rather poor plumage, so that I would hesitate, without a series of *sibirica* at hand, to place my specimen in that species. There is a single record of *sibirica* from Palawan.

Cyornis lemprieri Sharpe.

Lempriere's cyornis was not abundant but was rather well distributed and of sylvan habits. My records are from Brooke's Point, Dandelit, Candauaga, and Balabac. Specimens were taken at the first three localities.

Two of my males are typical *Cyornis lemprieri*, but a third, No. 1445, is indistinguishable from *C. philippinensis* by the characters usually given for the separation of the two species. The orange hue of the under surface of the body is no paler than in my Luzon birds, and while the throat is paler, inclining to whitish, the same character is exhibited in some specimens of *C. philippinensis*. With this fact in mind I made a comparison of my specimens with the series in the Bureau of Science collection and found the existence of other characters which serve very well to separate the two forms, as represented in the two collections. In all of the males of *C. philippinensis* the black chin spot is present and well marked. In some of the males of *C. lemprieri* this spot is also present but never to the extent exhibited by the maximum of *philippinensis*, while it is sometimes entirely lacking. Where it is present, the specimens all possess the lighter tints on breast and throat, as indeed they do in some cases where the chin is not black, but in all cases where the ventral coloration approaches that of *C. philippinensis* the black chin spot is lacking. In *C. lemprieri*, also, the sides of the breast average more broadly blue, and in one of my specimens the feathers across the breast are narrowly edged with blue. The females are, of course, unmistakable.

Cyanoptila bella (Hay).

On March 28 at Brooke's Point I collected a female of this interesting species at the edge of the forest, where it was conducting forays from a perch on a vine-covered stump, darting out after insects and returning to its post in true flycatcher fashion. It was the only one of its species that I saw.

Collected by Everett in Balabac, and recorded by him in 1895, the Japanese blue flycatcher has not been found since in the Philippines; nor is there any other evidence of its occurrence there except the notation by Sharpe in his Hand-list, in which Palawan Island is given as a habitat of the species as well as Balabac

—Balabac evidently on Everett's record, Palawan on evidence which I do not know.

Hypothymis occipitalis (Vigors).

The black-naped flycatcher was quite common and widely distributed. Records are from all points except Dadagican. Specimens were secured at Brooke's Point.

Rhipidura nigritorquis Vigors.

The only black-and-white fantails that I saw were at Bonabona on March 25 and 26. In both cases they were in the neighborhood of mangrove swamps.

Xeocephus cyaneus Sharpe.

I saw the large blue flycatcher at Brooke's Point and Candauga and in the mountains of the interior, but it was not very abundant at any of these places. Its habitat seemed to be the thickets and second growth of the forest. Specimens were taken at Brooke's Point.

CAMPOPHAGIDÆ

Artamides difficilis (Hartert).

The Palawan artamides was common throughout the forest, where it remained in the higher branches. I usually saw the species in pairs, though sometimes singly. It was rather impassive, neither obtrusive nor retiring. Records are from all points but Dadagican. Specimens are from Brooke's Point.

Periorocotus igneus Blyth.

The brilliant little fiery minivet was observed only at Brooke's Point and Puerto Princesa, at both of which places specimens were taken. Not many individuals were seen. It was always in the deep forest, very active and constantly moving about from place to place. Its note was a rapid twitter much like that of *P. cinereus*. This latter species I did not see, but since it has been found in Palawan by other workers, it may have been the author of the song on some of the occasions when I heard but could not see the minivets.

Lalage niger (Forster).

I saw a few examples of the pied lalage in the forest at Brooke's Point and Candauga. Although common enough in certain other parts of the Archipelago, this species does not seem to have been recorded from Palawan by many observers.

***Ægithina viridis* (Bonaparte).**

This pretty little species was found rather commonly at Brooke's Point, but at none of the other localities except Bonabona. Its favorite haunts were in the thickets of the more open country, though it occasionally visited the deep forest. For some time I heard the distinctive note of some bird I did not know, given from the upper foliage of the forest trees, but all my efforts to locate and identify the singers were unavailing. Even when I collected *A. viridis* in the forest, I did not associate it with the mysterious songsters, for the birds had been silent when I saw them. Later I found the more-favored resort of the species in the grassland thickets among the lower trees and less dense foliage, and there I was able to solve the puzzle, for the birds were singing plentifully and in full view.

PYCNONOTIDÆ

***Chloropsis palawanensis* (Sharpe).**

Leafbirds were noted in the forest at several localities, but owing to their leaf-colored plumage they were most difficult to see when in moderately dense foliage. I found them hard to kill outright with fine shot, a circumstance for which I could only account by the cottony texture of the plumage, which undoubtedly offered more or less resistance to the penetration of the pellets. I found the species present at Brooke's Point, Candauaga, and Puerto Princesa. Specimens are all from the neighborhood of Brooke's Point.

***Irena tweeddalei* Sharpe.**

Tweeddale's fairy bluebird was not uncommon in the deeper parts of the forest where I noted it most often in the vicinity of various fruit trees. It was inclined to be somewhat wary but was also inquisitive so that when I remained quiet enough it would often come quite close, although a sudden motion on my part would send it off again. The males, truly magnificent birds, were much more in evidence than the plainer females, which latter seemed to be of a more retiring disposition. My records are from Brooke's Point, Candauaga, and Puerto Princesa, at all of which places specimens were secured.

***Microtarsus atriceps* (Temminck).**

The black-headed bulbul was commonly noted at several places. Usually it was at the edge of the forest or in thickets on the plains. Sometimes it was found singly, at other times in flocks

of a dozen or more. However, it was rather shy and hard to approach. My notes were made at Brooke's Point, Candauaga, Bonabona, and Puerto Princesa. Specimens were taken at Brooke's Point and Puerto Princesa.

Trichophorus frater (Sharpe).

The gray-throated hairy bulbul was quite common in the lower growths of the forest and about the fruit trees. It was given to a desultory sort of song of a somewhat conversational nature though hardly musical. Specimens were taken at Brooke's Point and Candauaga and the species was seen at all points visited except Dadagican.

Pycnonotus cinereifrons (Tweeddale).

The ashy-fronted bulbul was apparently less common than the preceding species, yet the lack of more records may have been on account of the birds' secretiveness, which sent them into the depths of the thickets at the slightest alarm and probably put them in hiding many times before I caught sight of them. Records and specimens are from Brooke's Point, Candauaga, and Bonabona.

TIMALIIDÆ

Turdinus rufifrons (Tweeddale).

I took two rufous-headed babblers at Brooke's Point and in the mountains shot one other, which was unfit to preserve. The species is reported to be a good whistler, but the individuals that I saw were silent.

Mixornis woodi Sharpe.

The Palawan tit babbler was very common over most of the region and was found about brush piles and in the thickets and undergrowths of both the deep forest and the more open country. It was quite fearless and could be approached rather closely. It was a very active little bird, almost constantly poking about its favorite haunts, usually close to the ground. My records are from all localities except Sarong and Dadagican. Specimens were taken at Brooke's Point only.

TURDIDÆ

Petrophila manillensis (J. R. Forster).

Eastern rock thrushes were fairly common in Palawan, about as numerous as in the rest of the Archipelago. I saw individuals at all localities except Sarong and Dadagican.

***Kittacincla nigra* Sharpe.**

The Palawan black shama was the chief musician of the forests where I found it. Its sweet song had a wide range of tone and a number of variations, which the bird was not at all chary of demonstrating, although while performing it liked to keep hidden in the shelter of the fern thickets and other undergrowth. When startled, it did not fly far but took refuge quite near at hand behind the first convenient screen or at a little greater distance in the open. Except at Sarong and Dadagican it was noted regularly. Specimens were taken at Brooke's Point.

SYLVIIDÆ***Locustella oohotensis* (Middendorf).**

I found the yellow grasshopper warbler by sheer luck, on March 17. I had just shot an *Ægithina viridis* from a low tree on the cogon plain, behind the forest at Brooke's Point, and had stooped to pick the specimen from the ground, when I saw a small brown bird disappearing into a patch of tall *talahib* grass. With my specimen in one hand, I steadied the gun and fired at the disappearing bird, which must have been out of sight before the charge of shot reached the place. I went forward, hardly hoping for success, but on parting the grass stems I found the warbler where it had fallen. This is the first record of *L. oohotensis* from the Palawan group of islands. It is not a common bird anywhere in the Philippines.

***Orthotomus ruficeps* (Lesson).**

Rufous-headed tailorbirds were not common. I usually found them in the thickets and brush piles, where they skulked wren-like, and for the most part silent. Individuals were seen at Brooke's Point, Sarong, Candauaga, and Bonabona. Specimens were taken at Brooke's Point.

ARTAMIDÆ***Artamus leucorhynchus* (Linnæus).**

The white-bellied swallow shrike was common about dead trees in the clearings and at the edge of the forest. It was noted at Brooke's Point, Dadagican, Candauaga, Bonabona, Tagbariri, Calatugas, and Puerto Princesa.

LANIIDÆ***Otomela lucionensis* (Linnæus).**

A single shrike of the genus *Otomela* was noted at Brooke's Point on March 8 but was not taken. As there is a possible

doubt as to the exact species which this bird may have been, I have bracketed the record, but I have little hesitation in referring it to the present form.]

Hyloterpe whiteheadi Sharpe.

The Palawan thickhead was rare. Three specimens only were secured, and these were all that I saw. All three birds were in the deep forest at Brooke's Point, shy and elusive.

PARIDÆ

Pardaliparus amabilis (Sharpe).

The Palawan titmouse was rather common in the forest, although not abundant. When seen it was sometimes associated with other species of birds, sometimes alone, but usually in small flocks of four or five individuals of its own kind. Records are from Brooke's Point, Sarong, Dandelit, Candauaga, Bonabona, and Balabac. Specimens are from Brooke's Point.

SITTIDÆ

Callisitta palawana (Hartert).

It was only at Brooke's Point that I saw the Palawan nuthatch, but it seemed to be moderately common at that locality. It was a strictly forest form, very active and energetic, with the characteristic nuthatch habits of travelling upward, downward, or sideways, right side up or the reverse with equal facility, while exploring the cracks and crannies of the bark in search of food. Specimens were taken.

DICÆIDÆ

Dicæum pygmæum (Kittlitz).

Pygmy flowerpeckers were common in the forests at Brooke's Point, Sarong, Candauaga, and Bonabona. They often came to within a few feet of me, apparently impelled by curiosity and not at all governed by fear of the intruder.

Prionochilus johannæ Sharpe.

The Palawan flowerpecker was found commonly in the forest at Brooke's Point, Sarong, Dandelit, Candauaga, Bonabona, Tagbariri, Calatugas, Puerto Princesa, and Balabac. It was a quite fearless and very active little bird. Specimens were secured at Brooke's Point.

Acmonorhynchus affinis sp. nov.

Characters of the species.—Very similar to *Acmonorhynchus æruginosus* (Bourns and Worcester) but upper parts decidedly

more greenish; remiges and rectrices with broader, brighter olivaceous edging; terminal white spots on outer rectrices smaller, more sharply defined; under parts paler generally but with the pale areas, though more extensive, less pure white; ventral streaks indistinct or obscured by pale margins to feathers; size smaller; bill shorter and broader in proportion, more obtuse. Sexes similar.

Type.—No. 1446, male, adult, collection of J. T. Zimmer; Brooke's Point, Palawan, P. I., March 14, 1916, collected by J. T. Zimmer.

Description.—Above olivaceous, back and interscapulars between dark citrine and warbler green, becoming browner on the head, brighter and more yellowish on rump and upper tail coverts, which are nearly pyrite yellow; wing coverts, remiges, and rectrices chaetura black broadly edged with olive yellow, becoming strontian yellow on outer primaries, tertials tipped with olive yellow; two outer pairs of rectrices with sharply defined, narrow terminal spot of white on inner web; feathers of whole top of head with darker brown centers; forehead inclining to ashy; lores whitish; a narrow eye ring pale yellow; a white malar line separated from the throat by an indistinct brown line; throat white; rest of under parts white with a buffy tinge, almost marguerite yellow; breast, flanks, and sides of abdomen indistinctly streaked with dark hair brown, more or less obscured by pale margins to the feathers; under tail coverts with median, basal brown markings. Length, 111 millimeters; wing, 63; tail, 35; tarsus, 14; culmen from base, 7; bill from nostril, 5; greatest width of bill, 7.²

Type.—No. 1499, female, adult, collection of J. T. Zimmer; Brooke's Point, Palawan, P. I., March 31, 1916, collected by J. T. Zimmer.

Description.—Indistinguishable from the male in general appearance. Length, 112 millimeters; wing, 60; tail, 32; tarsus, 14; culmen from base, 8; bill from nostril, 6; greatest width of bill, 7.

Only two individuals of this species were seen, the two which constitute the types. They were found in the deep forest asso-

² A series of four adult males of *A. xeruginosus* in my collection from Luzon have the following respective measurements (in millimeters): Length, 116, 117, 118, 118; wing, 66, 66.5, 66, 67; tail, 35, 37, 38, 38; tarsus, 14, 14, 14, 14; culmen from base, 9, 9, ?, 9; bill from nostril, 6.5, 6.5, ?, 7; greatest width of bill, 7, 7, 6.5, 6.5. One specimen has the tip of its bill damaged; hence the interrogations.

ciated with *Prionochilus johannæ* in both cases. So far as I know there are no other records of any birds of this genus having been found on Palawan.

NECTARINIIDÆ

Æthopyga shelleyi Sharpe.

Shelley's sunbird was quite rare, but it was occasionally found in the forest in company with other species of sunbirds. Its song was a peculiar, thin pipe, very high in tone, difficult to describe, but quite distinctive and unmistakable when once heard. Records and specimens are from Brooke's Point and Balabac.

Cinnyris sperata (Linnæus).

The red-breasted sunbird was seen occasionally in company with other species of the family, but it was rather uncommon and more wary than the others, and was usually the first to take alarm. The brilliant plumage of the males made them conspicuous even at a distance, while if they were in the bright sunlight they were dazzling. I noted the species only at Brooke's Point, where I secured four males.

Cinnyris aurora (Tweeddale).

The dap-dap, or coral, trees (*Erythrina indica*?) were in full bloom at Brooke's Point, and about their flaming blossoms were scores of bright-hued sunbirds of several species among which the present one was most in evidence. One of these trees, not a great distance from the house, was one of the liveliest spots in the forest. At times I have seen parrots, cockatoos, leaf-birds, nuthatches, chickadees, woodpeckers, orioles, flowerpeckers, sunbirds of various kinds, spider-hunters, pigeons, and starlings, all in this tree at once, while in nearby foliage were cuckoos, fairy bluebirds, flycatchers, minivets, thrushes, tailor-birds, bulbuls, and the like. The clamor was indescribable, and the conglomeration of assorted colors exhibited by the assemblage and set off by the brilliant blossoms of the tree was most striking and yet harmonious. Toward the latter part of my stay in the region the dap-daps began to drop their flowers and put out leaves and the host of visitors once accustomed to assemble and feast on these hospitable branches now sought other places of entertainment. Then these spots where I had previously found the bird life most abundant became by comparison quite deserted.

Cinnyris aurora was noted at every locality visited. Specimens were secured at Brooke's Point.

***Anthreptes malaccensis* (Scopoli).**

The brown-throated sunbird was common, particularly about the dap-dap trees. The localities of observation were Brooke's Point, Sarong, Candauaga, Bonabona, and Balabac. Specimens were taken at Brooke's Point.

***Arachnothera dilutior* Sharpe.**

Pale spider-hunters were not common, but I saw them occasionally at Brooke's Point, sometimes in company with other birds about the fiery dap-daps, sometimes alone in the deeper forest. To me they always appeared grave and solemn, with owlsh demeanor, this aspect being due, no doubt, partly to their quiet habits and partly to their long bills and "spectacled" eyes. Most of my records are from Brooke's Point as are all of my specimens. One bird was seen at Bonabona.

MOTACILLIDÆ***Motacilla ocularis* Swinhoe.**

I noted the streak-eyed wagtail only at Brooke's Point. On March 11 I saw two of these wagtails on the beach; they were very wild and would not permit me to approach, but flew off around a point where I could not follow them. The following day I revisited the sandspit where I had seen the wagtails in the hope of seeing them again and possibly of securing specimens. I was partially successful. One bird was present. As before, it flew immediately upon sighting me, but it alighted on the beach nearby, and by keeping some shrubbery between myself and the bird I managed to get close enough for a long shot. The specimen I thus obtained was a female in molt with the chin and throat black centrally and white laterally. Otherwise the plumage is the full summer one.

***Motacilla melanope* Pallas.**

The gray wagtail was rather common about the cleared ground near the settlement at Brooke's Point, but it was not seen elsewhere.

***Budytes leucostriatus* Homeyer.**

The Siberian yellow wagtail was noted at Brooke's Point and Bonabona usually, except at the last named locality, in company with the preceding species. One specimen was taken.

***Anthus gustavi* Swinhoe.**

The Petchora pipit was frequently flushed from the ground in the deep forest at Brooke's Point. Usually when flushed it flew for only a short distance before alighting on the ground

again. Sometimes it did not fly at all, but ran or walked rapidly away not in a straight line but by a tortuous course behind plants, bits of rubbish and the like, which concealed its movements and helped it to escape. On a few occasions it ascended to the branches of nearby trees, sometimes to a considerable height. Although not rare at Brooke's Point the species was not found at any other locality. Several specimens were taken.

Anthus cervinus (Pallas).

At Brooke's Point there were one or two flocks of red-throated pipits, which could usually be found in a clearing at the edge of the forest near the settlement. There I took six specimens, which exhibit a wide gradation of plumage, ranging from the garb of the young bird to full adult livery. Birds with the streaked, young plumage were most in evidence.

PLOCEIDÆ

Munia jagori Martens.

Philippine weavers were common in the grassland and rice fields, where they occurred in small flocks, usually among the plants near the ground and consequently unseen until they whirled up from underfoot. I saw the species at Brooke's Point, Sarong, Candauaga, Bonabona, Tagbariri, and Puerto Princesa.

Munia cabanisi Sharpe.

Cabanis's weaver was less common than the preceding species, but was found in the same habitat and at the same localities.

ORIOIDÆ

Oriolus acrorhynchus Vigors.

The brilliant golden and black plumage of the Philippine oriole made it a conspicuous bird wherever it was found, and it was present throughout the region. My records are from all points except Dadagican. A single immature specimen was taken at Brooke's Point.

Oriolus xanthonotus Horsfield.

The black-headed oriole was rare and seen only at Brooke's Point. It was solitary and silent, and seemed fond of concealing itself in the denser parts of the foliage and of the forest. Three specimens were secured.

DICRURIDÆ

Dicruropsis palawanensis (Tweeddale).

The Palawan drongo was common in the forest at Brooke's Point and Candauaga but was not seen elsewhere. It was very

inquisitive in habits but was rather inclined to disappear, once its curiosity was satisfied. Specimens were taken at Brooke's Point.

Bhuchanga palawanensis Whitehead.

The Palawan gray drongo was seen at Brooke's Point, Candauaga, Bonabona, Calatugas, and Balabac. Specimens were secured at Brooke's Point. This bird was extremely graceful on the wing and seemed fond of performing its aerial evolutions. Along the trails and in the deeper parts of the forest it was often seen darting about through the trees or resting momentarily between flights.

STURNIDÆ

Sturnia philippensis (Forster).

At Tagbariri on April 6 I collected two females of this species from a flock, which had alighted in the top of a large dead tree. I saw no others in the region.

EULABETIDÆ

Eulabes palawanensis Sharpe.

The Palawan wattled myna was common in the forests and was seen at all points except Dadagican and Puerto Princesa. These birds are very interesting performers and have a variety of catcalls, whistles, squeaks, and whining notes, some of them quite unbirdlike and none of them musical. They often imitate their neighbors in the forest—birds and other creatures—sometimes with considerable success. They also readily learn to talk, for which reason they are common cage birds among the natives of the region. Specimens were taken at Brooke's Point.

Lamprocorax panayensis (Scopoli).

The Philippine glossy starling was abundant throughout the forest and about the dead trees in the clearings. Some of the birds appeared to be paired, such couples often keeping to themselves, but most of them were in flocks of a dozen or more individuals. They are compact little birds and can fly quite fast when they choose. I recorded the species at every locality except Dadagican and secured specimens at Brooke's Point.

CORVIDÆ

Corvus pusillus Tweeddale.

The little crow was rather common at all points except Dadagican. It was often heard, but it was very shy and was quick to take alarm when approached.

Record of specimens of birds collected in Palawan Island in 1916.

Name.	No.	Sex.	Locality.	Date.
<i>Turnis fasciata</i> (Temminck)	1524	♂	Tagbariri	April 6.
<i>Treron nipalensis</i> (Hodgson)	1489	♂	Brooke's Point	March 23.
	1497	♂	do	March 31.
	1498	♀	do	Do.
<i>Muscadivores palawanensis</i> (Blasius)	1487	♀	do	March 15.
	1490	♂	do	March 23.
<i>Spilopelia tigrina</i> (Temminck and Knip)	1491	♀	do	Do.
<i>Squatarola squatarola</i> (Linnaeus)	1509	♂	do	April 1.
<i>Ochthodromus geoffroyi</i> (Wagler)	1515	♀	do	April 2.
<i>Numenius variegatus</i> (Scopoli)	1487	♀	Sarong	March 18.
	1468	♀	do	Do.
<i>Demigretta sacra</i> (Gmelin)	1459	♂	Brooke's Point	March 17.
	1466	♀	Sarong	March 18.
<i>Cacatua hematuropygia</i> (P. L. S. Müller)	1384	♀	Brooke's Point	March 9.
	1385	♀	do	Do.
	1449	♂	do	March 14.
	1420	♂	do	March 12.
<i>Prioniturus cyaneiceps</i> (Sharpe)	1421	♀	do	Do.
	1450	♀	do	March 15.
	1510	♂	do	April 2.
	1358	♂	do	March 6.
<i>Tanygnathus lucionensis</i> (Linnaeus)	1359	♂	do	Do.
	1514	♂	do	April 2.
<i>Gymnolaimus semperi</i> (Sharpe)	1424	♀	do	March 12.
	1395	♂	do	March 9.
	1402	♂	do	March 10.
	1401	♀	do	Do.
<i>Caprimulgus macrurus</i> Horsfield	1443	♂	do	March 13.
	1442	♂	do	Do.
	1439	♂	do	Do.
	1440	♂	do	Do.
	1441	♀	do	Do.
<i>Cacomantis merulinus</i> (Scopoli)	1444	♀	do	March 14.
<i>Chalcococcyx zanthorhynchus</i> (Horsfield)	1351	♂	do	March 6.
	1381	♂	do	March 3.
	1485	♂	do	March 23.
<i>Eudynamis mindanensis</i> (Linnaeus)	1488	♂	do	Do.
	1487	♀	do	Do.
	1374	♀	do	March 3.
<i>Dryococcyx harringtoni</i> Sharpe	1469	♂	Balabac	March 20.
	1473	♀	Candauaga	March 22.
	1483	♀	Bonabona	March 25.
<i>Tiga everetti</i> Tweeddale	1342	♂	Brooke's Point	March 5.
	1386	♂	do	March 9.
<i>Thriponax hargitti</i> Sharpe	1480	♂	do	March 17.
<i>Pitta propinqua</i> (Sharpe)	1496	♂	do	March 31.
	1419	♂	do	March 12.
<i>Pitta atricapilla</i> Lesson	1496	♂	do	March 30.
	1470	♂	Balabac	March 20.
<i>Hemichelidon priocincta</i> Swinhoe	1477	♂	Candauaga	March 22.
	1511	♂	Brooke's Point	April 2.

Record of specimens of birds collected in Palawan Island in 1916—Cont.

Name.	No.	Sex.	Locality.	Date.
<i>Cyornis lemprieri</i> Sharpe	1483	♂	do	March 18.
	1445	♂	do	March 14.
	1472	♀	Dandelit.	March 21.
	1482	♂	Candauaga	March 23.
<i>Cyanoptila bella</i> (Hay)	1481	♀	do	Do.
	1494	♀	Brooke's Point	March 28.
	1858	♂	do	March 6.
<i>Hypothymis occipitalis</i> (Vigors)	1488	♀	do	March 13.
	1410	♂	do	March 11.
	1409	♀	do	Do.
	1426	♂	do	March 12.
<i>Xeocephus cyaneus</i> Sharpe	1485	♂	do	March 13.
	1521	♂	do	April 8.
	1346	♂	do	March 5.
	1845	♀	do	Do.
	1378	♂	do	March 7.
<i>Artamides difficilis</i> (Hartert)	1413	♀	do	March 11.
	1389	♂	Puerto Princessa	March 4.
	1429	♂	Brooke's Point	March 12.
<i>Pericrocotus igneus</i> Blyth	1428	♀	do	Do.
	1451	♂	do	March 15.
	1452	♀	do	Do.
	1464	♂	do	March 17.
<i>Myiophobus viridis</i> (Bonaparte)	1468	♀	do	Do.
	1354	♂	do	March 6.
	1365	♂	do	March 7.
	1361	♀	do	Do.
	1364	♀	do	Do.
<i>Chloropsis palawanensis</i> (Sharpe)	1512	♀	do	April 2.
	1520	♂	do	April 3.
	1340	♀	Puerto Princessa	March 4.
	1417	♂	Brooke's Point	March 12.
	1418	♂	do	Do.
	1416	♀	do	Do.
<i>Irena tweeddalei</i> Sharpe	1475	♂	Candauaga	March 22.
	1476	♂	do	Do.
	1474	♀	do	Do.
	1341	♂	Puerto Princessa	March 4.
	1390	♂	Brooke's Point	March 9.
<i>Microraneus atriceps</i> (Temminck)	1430	♂	do	March 12.
	1434	♂	do	March 13.
	1347	♂	do	March 6.
	1356	♀	do	Do.
	1378	♂	do	March 8.
<i>Trichophorus frater</i> (Sharpe)	1412	(?)	do	March 11.
	1447	♂	do	March 14.
	1480	♂	Candauaga	March 22.
	1392	♂	Brooke's Point	March 9.
<i>Pycnonotus cinereifrons</i> (Tweeddale)	1478	♂	Candauaga	March 22.
	1479	♂	do	Do.
	1507	♂	Brooke's Point	April 1.
	1513	♂	do	April 2.

Record of specimens of birds collected in Palawan Island in 1916—Cont.

Name.	No.	Sex.	Locality.	Date.
<i>Turdinus rufifrons</i> (Tweeddale)	1431	♂	do	March 13.
	1432	♀	do	Do.
	1369	♂	do	March 7.
	1380	♂	do	March 8.
	1376	♂	do	Do.
<i>Mizornis woodi</i> Sharpe	1877	♀	do	Do.
	1454	♂	do	March 15.
	1465	♂	do	March 17.
	1516	♂	do	April 4.
	1350	♂	do	March 6.
<i>Kittacincla nigra</i> Sharpe	1355	♂	do	Do.
	1375	♂	do	March 8
	1437	♀	do	March 13.
	1462	♂	do	March 17.
	1371	♀	Brooke's Point	March 7.
<i>Orthotomus ruficeps</i> (Lesson)	1422	♂	do	March 12.
	1436	♂	do	March 13.
	1423	♂	do	March 12.
<i>Hyloterpe whiteheadi</i> Sharpe	1456	♂	do	March 15.
	1453	♀	do	Do.
	1343	♂	do	March 5.
<i>Pardaliparus amabilis</i> (Sharpe)	1492	♀	do	March 29.
	1344	♂	do	March 5.
	1455	♀	do	March 15.
<i>Callisitta palawana</i> (Hartert)	1506	♂	do	April 1.
	1348	♂	do	March 6.
	1399	♂	do	March 10.
<i>Prionochilus johanne</i> Sharpe	1403	♀	do	March 11.
	1501	♀	do	March 31.
	1446	♂	do	March 14.
<i>Aemonorhynchus affinis</i> Zimmer sp. nov	1499	♀	do	March 31.
	1370	♂	do	March 7.
	1471	♂	Balabac	March 20.
<i>Althopygia shelleyi</i> Sharpe	1366	♂	Brooke's Point	March 7.
	1368	♂	do	Do.
	1388	♂	do	March 9.
<i>Cinnyris spurata</i> (Linnaeus)	1448	♂	do	March 14.
	1367	♂	do	March 7.
	1293	♂	do	March 9.
<i>Cinnyris aurora</i> (Tweeddale)	1394	♀	do	Do.
	1398	♀	do	March 10.
	1407	♀	do	March 11.
<i>Anthreptes malaccensis</i> (Scopoli)	1360	♂	do	March 7.
	1363	♂	do	Do.
	1362	♂	do	Do.
<i>Anthreptes malaccensis</i> (Scopoli)	1391	♂	do	March 9.
	1400	♂	do	March 10.
	1406	♂	do	March 11.
<i>Anthreptes malaccensis</i> (Scopoli)	1405	♂	do	Do.
	1408	♀	do	Do.
	1504	♀	do	April 1.

Record of specimens of birds collected in Palawan Island in 1916—Cont.

Name.	No.	Sex.	Locality.	Date.
	1389	♂	do	March 8.
<i>Arachnothera diluvior</i> Sharpe	1404	♂	do	March 11.
	1411	♂	do	Do.
	1486	♀	do	March 27.
<i>Motacilla ocularis</i> Swinhoe	1427	♀	do	March 12.
<i>Dudytes leucostriatus</i> Homeyer	1508	♂	do	March 31.
	1458	♂	do	March 16.
<i>Anthus gustavi</i> Swinhoe	1494	♀	do	March 30.
	1505	♂	do	April 1.
	1492	♂	do	March 29.
	1500	♀	do	March 31.
<i>Anthus cervinus</i> (Pallas)	1502	♀	do	Do.
	1519	♂	do	April 2.
	1517	♀	do	Do.
	1518	♀	do	Do.
<i>Oriolus acrorhynchus</i> Vigors	1387	♀	do	March 9.
	1357	♂	do	March 6.
<i>Oriolus zanthonotus</i> Horsfield	1396	♀	do	March 10.
	1461	♂	do	March 17.
<i>Dieruopsis palawanensis</i> (Tweeddale)	1397	♀	do	March 10.
	1508	♂	do	April 1.
<i>Rhuchanga palawanensis</i> Whitehead	1352	♂	do	March 6.
	1349	♀	do	Do.
<i>Sturnia philippensis</i> (Forster)	1522	♀	Tagbariri	April 6.
	1523	♀	do	Do.
	1372	♂	Brooke's Point	March 7.
<i>Lamprocorax panayensis</i> (Scopoli)	1379	♀	do	March 8.
	1425	♂	do	March 12.
	1382	♀	do	March 8.
<i>Eulabes palawanensis</i> Sharpe	1415	♂	do	March 11.
	1414	♀	do	Do.

TWO NEW SNAKES OF THE GENUS *HOLARCHUS* WITH DESCRIPTIONS OF OTHER PHILIPPINE SPECIES

By EDWARD H. TAYLOR

(From the Section of Fisheries, Biological Laboratory,
Bureau of Science, Manila)

TWO PLATES

Two recognized species of the genus *Holarchus*¹ have been described from the Philippine Islands; these are *Holarchus meyerlinkii* Steindachner² and *Holarchus ancorus* Girard.³ In this paper *Holarchus maculatus* from central eastern Mindanao and *Holarchus burksi* from Mindoro are described as new.

Genus *HOLARCHUS* Cope

Coronella, part., SCHLEGEL, Phys. Serp. (1837), 2, 50.

Xenodon, part., SCHLEGEL, op. cit., 80.

Simotes, part., DUMÉRIL and BIBRON, Mem. Ac. Sc. (1853), 23, 472; and Erp. Gén. (1854), 7, 624; GÜNTHER, Cat. Col. Sns. (1858), 23; JAN, Arch. Zool. Anat. Phys. (1863), 2, 232; GÜNTHER, Rept. Brit. Ind. (1864), 212; BOULENGER, Faun. Ind., Rept. (1890), 309; Cat. Sns. Brit. Mus. (1894), 2, 214.

Holarchus COPE, Proc. Am. Philos. Soc. (1886), 23, 488; STEJNEGER, Bull. U. S. Nat. Mus. (1907), 58, 333.

Dicraulax COPE, Am. Nat. (1893), 480.

¹ Stejneger [Bull. U. S. Nat. Mus. (1907), 58, 353] states: "The generic name *Simotes*, by which the snakes of this genus have long been designated is preoccupied by *Simotes* of Fischer for a group of mammals as early as 1817. It has consequently to be replaced. Cope proposed *Holarchus* in 1887, as a term for those species of the genus which have an undivided anal. It is not believed that this character alone which moreover is not always constant, is sufficient ground for a division of the genus, and as *Holarchus* is the name next in date after *Simotes* it must stand for the combined genus."

² Boulenger [Cat. Sns. Brit. Mus. (1894), 2, 224] has united this form with the southern Asiatic species *Simotes octolineatus* Schneider. He distinguishes it as Form C. Barbour [Mem. Mus. Comp. Zool. Harv. Coll. (1912), 44, 118] states: "It is very probable that '*Simotes meyerlinkii*' which Steindachner described from the Sulu Islands, is a valid species; it deserves a subspecific rank at least. The number of ventrals is low, 158 in Boulenger's specimen from Tawi-Tawi, and 156-161 according to Steindachner. The color is distinctive."

³ Boulenger (op. cit., 225) has placed *Xenodon ancorus* Girard as a questioned synonym of this species. I am confident that these species are identical. Consequently the name *ancorus* of Girard will have precedence over *phænochalinus* of Cope, as the former antedates the latter by three years.

*Description (from Boulenger).—*Maxillary teeth eight to twelve, posterior very strongly enlarged and compressed; mandibular teeth subequal. Head short, not distinct from neck; eye rather small with round pupil; rostral large. Body cylindrical; scales smooth or feebly keeled, in 13 to 21 rows, with or without apical pits; ventrals rounded or obtusely keeled laterally. Tail short or moderate; subcaudals in two rows. Southern China, East Indian Archipelago. Four species are known to occur in the Philippine Islands.

Key to the Philippine species of Holarchus.

a'. Anal entire; scales in 17 rows.

b'. Third and fourth labials entering eye.

c'. Loreal as long as deep. Brown with a pink medial longitudinal line, an indistinct lateral line, and a row of dim black spots on second scale row. Below bright rose.

H. meyerlinkii Steindachner.

c". Loreal longer than deep. Pale brownish to lavender with 19 transverse dark spots. Below yellow to bright pink.

H. ancorus Girard.

b". Fourth labial entering eye; loreal absent. Pale lavender with 22 or 23 dark blackish brown dorsal blotches; yellowish below with black spots on ventrals..... *H. maculatus* sp. nov.

a". Anal divided; fourth labial entering eye; loreal present, little longer than wide. Dark purplish brown with a dull salmon streak dorsally; 22 narrow transverse blotches *H. burksi* sp. nov.

Holarchus meyerlinkii Steindachner.

Simotes meyerlinkii STEINDACHNER, Sitzb. Ak. Wien (1891), 294; BARBOUR, Mem. Mus. Comp. Zool. Harv. Coll. (1912), 44, 118.

Simotes octolineatus BOULENGER, var. c., Cat. Sns. Brit. Mus. (1894), 2, 224.

Description of species.—Rostral broader than deep, the portion seen from above a little more than half its distance from the frontal; the internasals much smaller than the prefrontals, the suture between them little less than that between the prefrontals; latter broader than long, touching only the posterior part of nasal; frontal much longer than wide, longer than its distance from the end of the snout, longer and wider than the supraocular and longer than the parietals; latter longer than broad, bordered by two temporals, touching one postocular; nasal partially divided, longer than deep; a small square loreal present; preocular twice as long as wide; two postoculars, upper nearly twice as large as the lower; temporals 2 + 2, only the first upper touching the postoculars; six upper labials, the third and fourth entering the eye; the sixth and fifth rather narrowly in contact; mental small; seven lower labials (six on right side)

the first four bordering the first pair of chin shields (three on right side); second pair of chin shields about one-half as large as first pair; scales in 17 rows; 162 ventrals, rather angulate; anal single; subcaudals, 43; eye moderate, its diameter equal to its distance from anterior part of nostril.

Color in life.—Above reddish brown, with a median, salmon-pink longitudinal stripe covering one whole row, and two half scale rows; each scale of the median row with a darker center; laterally a dim grayish longitudinal stripe; on the second outer row of scales a series of dark dots; a series of dim dark spots on the outer edge of the ventrals. Head darker brown, with elongate black spots on the frontal and on the inner part of the parietals; a black stripe runs diagonally from neck to parietal; a dark spot below the eye. Belly bright rosy pink.

Measurements.—Total length, 305 millimeters; tail, 48.

Remarks.—This species appears to be confined to Sulu Archipelago; the only definite records are Tawitawi and Bongao.* These two records seem to be the only ones other than the types, which are labeled Sulu Islands with no definite localities named. This species is separated from *Holarchus octolineatus* on the basis of its distinctive coloration and the much fewer ventrals and subcaudal scales. The description is based on a single specimen collected by myself on Bongao, Sulu Archipelago, Philippine Islands, October 14, 1917.

Holarchus ancorus Girard.

Xenodon ancorus GIRARD, Proc. Acad. Philadelphia (1857), 182; U. S. Exp. Expedit., Herp. (1858), 167.

Simotes purpurascens var. c. part., GÜNTHER, Cat. Col. Sns. (1858), 25.

Simotes phaenochalinus COPE, Proc. Acad. Philadelphia (1860), 244; BOULENGER, Cat. Sns. Brit. Mus. (1894), 2, 225.

Simotes ancoralis JAN, Arch. Zool. Anat. Phys. (1863), 2, 233; Icon. Gén. (1865), 11, Pl. VI, fig. 2; STEINDACHNER, Novara Rept. (1867), 61.

Holarchus phaenochalinus GRIFFIN, Phil. Journ. Sci., Sec. D (1911), 6, 259.

Description of adult male.—No. R429, E. H. T. collection. Manila, P. I., June 15, 1915. E. H. Taylor, collector. Rostral large, much higher than wide; portion seen above nearly equal to its distance from the frontal, sharply pointed behind; internasals small, wider than deep, their shortest suture being be-

* Barbour, loc. cit., states: "*H. meyerlinkii* (Steind.) was doubtless evolved by isolation from specimens of this species probably derived from Borneo."

tween the two, their longest suture with the prefrontal; the latter nearly twice as wide as deep, the suture between them somewhat longer than that between the internasals; frontal much wider in front than behind, longer than its distance from the end of the snout, little longer than wide, twice the width of the supraocular; parietals scarcely longer than wide, equal to or a little longer than the frontal; nasal partially divided, the anterior part largest; loreal longer than wide; one preocular, two postoculars; the supraocular twice as long as wide; temporals 1+2; seven upper labials, the third and fourth entering the eye; seven or eight lower labials, the first four in contact with the first pair of chin shields; mental small, wider than deep, not in contact with the anterior chin shields, which are one and one-half times the length of the posterior; scales in 17 smooth rows with no apical pits; eye large, equal to its distance from the nostril; ventrals, 163; anal single; subcaudals, 42. Eye less than its distance from the nostril.

Color in life.—Brownish lavender above with a series of eighteen large dark purplish spots edged with black, each extending across the back to the first or second row of scales; below immaculate cream yellow; subcaudals with dull brown spots; a large anchor-shaped, black-edged spot on the nape of the neck and on head, the front of which forms a band that crosses the head and eyes diagonally and includes the fifth and sixth labials; the main branch of the anchor, which runs back medially, increases in width toward the neck where it bifurcates, sending a branch to each side of the neck; a diagonal temporal streak present. Traces of a yellowish vertebral streak visible. Length, 551 millimeters; tail, 92.

Variation.—There seems to be much variation in this species as shown in Table I. The only definite localities given are on Luzon, and it is highly probable that specimens without locality marks are also from that island. The ventrals vary between 149 and 165; the subcaudals, 34 and 43. The temporals vary equally between 1+2 and 2+2. One specimen (No. 1554, Bureau of Science collection) has only a single labial entering the eye, which is the third; however there is an obvious fusion of the third and fourth labials. In No. 700, Bureau of Science collection, the anchor-shaped marking is disconnected on the frontal, thus following the marking in *H. burksi*. In all the specimens save the one described there are indications of narrow bands between the larger dark bands; they are usually represented by a few irregular dots across the body or merely by

TABLE I.—*Holarchus anconus* Girard.

No.	Sex or age.	Locality.	Length mm.	Tail. mm.	Ventrals.	Subcaudals.	Upper labials.	Lower labials.	Labials entering eye.	Scale rows.	Temporals.	Collection.
613	yg.	Manila.....	220	28	160	34	7	8	third and fourth.....	17	1+2	Bureau of Science.
709	yg.	Benguet.....	280	45	164	43	7	8	do.....	17	2+2	Do.
782	c'	Unknown.....	545	86	165	40	7	7	do.....	17	2+2	Do.
820	q	Zambales.....	475	65	163	37	7-8	7	do.....	17	2+2	Do.
910	♂	Bataan.....	515	86	163	42	7	7	fourth and fifth.....	17	1+2	Do.
1554	♂	Unknown.....	498	87	149	43	6	7	third and fourth.....	17	2+2	Do.
459	♂	Manila.....	551	92	163	42	7	8	third and fourth.....	17	1+2	E. H. Taylor.

lateral dots. No variations are noted in the number of preoculars, postoculars, anal, or loreals.

Remarks.—Boulenger³ has placed *Xenodon ancorus* (Girard)² as a questioned synonym of this species. The differences in the descriptions are obvious. There are two preoculars (the lower one is very small), and there are eight upper labials with the fourth and fifth entering the eye. It is highly probable that it is merely a variation from normal condition as it otherwise agrees with the normal form. In one of the specimens (No. 820, Bureau of Science collection) we have the increased number of labials on one side and the fourth and fifth labials entering the eye.

Holarchus maculatus sp. nov. Plate I.

Type.—No. 40, E. H. T. collection; Bunawan, Agusan, P. I., August, 1912. E. H. Taylor, collector.

Description of type.—Rostral moderate, higher than wide; portion visible above less than half its distance from the rostral; suture between the internasals as large as or larger than the prefrontal suture; prefrontals much larger than the internasals, in contact laterally with two labials; frontal hexagonal, its length equal to the parietals, a little longer than its distance from the end of the snout; parietals small, as wide as long; nasal not or at least only partially divided; the nostril pierced near the posterior margin; no loreal present; two small preoculars, upper twice as large as lower; supraocular not twice as long as wide; two postoculars; temporals 1+2 (on left side 1+1); seven upper labials, only the fourth entering the eye; labials in the following order of size: 6, 4, 5, 7, 3, 2, 1; mental small, twice as wide as deep; seven lower labials, three touching the first chin-shields, which are larger than the second pair; eye equal to its distance from the nostril or minutely less. Scales smooth, in 17 rows. Ventrals, 164; anal single; subcaudals double, 54 in number.

Color in life.—Above pale lavender with a series of twenty-three broad, blackish brown dorsal spots extending laterally to the ventrals. Dorsally they are seven or eight scales wide, but are narrowed laterally to a width of one or two scales; spots are edged with narrow whitish lines; the nuchal stripe runs forward and stops with a blunt point on the frontal scale; a narrow band crosses the head anteriorly and includes the

² Boulenger, Cat. Sns. Brit. Mus. (1894), 2, 225.

³ I have not seen the type.

eyes; a dark blotch on the temporals, which is connected with the band; small spots on the nasals; chin yellow; on the edges of one-half of the ventrals are small spots that involve one or two of the body scales; on each alternate ventral are two larger rectangular spots; throat variously spotted with dark. Ventral surface yellow; below tail, yellowish with no or very few spots. Total length, 299 millimeters; tail, 59.

Variation.—A second specimen taken at the same locality (No. 41, E. H. T. collection) is very different in scalation, but it seems to be an abnormal specimen. A small loreal is present on the right side of the head; two preoculars are fused into one on the left side. The first lower labial on both sides is broken in two, making it appear that there is a pair of minute chin shields behind the mental. The temporal elements on the right side are not normal, the parietal is broken and there are two anterior temporals. In coloration and marking they are practically identical.

TABLE II.—*Holarchus maculatus* sp. nov.; two specimens in collection of E. H. Taylor.

No.	Locality.	Length.	Tail.	Ventrals.	Subcaudals.	Upper labials.	Lower labials.	Preoculars.	Postoculars.	Loreal.	Labials enter eye.	Scale row.	Temporals.
		mm.	mm.										
40	Bunawan, Agusan.	299	59	164	54	7	7	2	2	0	1	17	2+8 1+3
41	do.	258	50	162	54	7	7	2-1	2	1-0	1	17	2+3 1+3

Remarks.—Both specimens are from Bunawan, Agusan. They were collected by myself from under piles of sod. This form is obviously different from other Philippine species. The markings are distinctive; the loreal is absent and only a single labial enters the eye; two preoculars are present. These characters together with many minor differences separate it from *H. meyerlinkii* and *H. ancorus*. From *H. burksi* it is separated by markings and coloration and the above mentioned characters, save that of the single labial entering the eye in which the two forms agree.

Holarchus burksi sp. nov. Plate II.

Type.—No. 200, E. H. T. collection. Sumagui, Mindoro, P. I., December, 1916. Clark Burks, collector.

Description of type.—Head rather distinct from the neck; rostral high, bending back over the snout, pointed behind; internasals narrowed on the inner side, much wider than long, the suture between them much less than the prefrontal suture; prefrontals somewhat rectangular in shape, almost twice as wide as long; frontal shield-shaped, much longer than its distance from the end of the snout, equal to the parietal in length, not twice as broad as the supraocular but of nearly equal length; parietals as broad as long, bordered by two temporals; nasal medium, undivided, the anterior portion much the higher; loreal large, longer than wide; a single elongate preocular, widely separated from the frontal; two subequal postoculars; temporals 1+2; seven upper labials, the fourth alone entering the eye; upper margin of labial series very much broken; seven lower labials, four touching the large chin-shields; second pair of chin-shields about one-half the size of first pair; scales in 17 rows, smooth; smallest scales dorsal, of angular shape; laterally, scales larger and rounding; ventrals, 154; anal divided; subcaudals, 32.

Color in life.—Above grayish brown, becoming grayer laterally, with a median, dorsal, salmon-pink streak the length of the body. Body traversed by twenty saddlelike blotches, which widen medially to the width of three scales and narrow greatly laterally, usually to the width of one scale. The blotches are black, inclosing a gray spot, dorsally, the entire blotch edged with a narrow grayish white line, less apparent medially. Between each two blotches laterally there is a series of two or three small, elongate, white-edged dark spots, each smaller than a scale. Neck with a forked blotch, each leg of which begins laterally at the seventh ventral and goes up and forward where the two meet medially, some distance behind the parietals, and run forward much narrowed to the middle of the frontal; a dark broad line present below the eye, which is more or less continuous with a band crossing the snout on about the anterior level of the eyes. A line beginning on second ventral runs up diagonally to the parietals; a spot below the nostril and another on the sixth labial. Two or three spots on the lower labials; four ventrals on neck with spots. Ventrally immaculate brilliant rosy pink, almost red toward end of body. Total length, 381 millimeters; tail, 47.

Remarks.—In markings this species resembles much the Philippine *Holarchus ancorus*, but it is well differentiated by a single labial entering the eye, the undivided nasal, and the divided anal. It agrees with *H. woodmasoni* and *H. maculatus* in having a single labial entering the eye. The differences from the

latter are pointed out under that species; from the former it differs by a very much reduced number of subcaudals and ventrals, and the undivided anal; the coloration also is totally different. Its closest affinity seems to be *H. beddomii*, which also has an undivided nasal and divided anal. This differs in having the fourth and fifth labials entering the eye, and the markings and colorations are quite different. I take pleasure in dedicating this handsome species to Mr. Clark Burks, who collected the unique specimen and presented it to me.

ILLUSTRATIONS

[Drawings by P. Moskalra.]

PLATE I. *Holarchus maculatus* sp. nov., from the type.

II. *Holarchus burksi* sp. nov., from the type.



PLATE I. *HOLARCHUS MACULATUS* SP. NOV.



PLATE II. *HOLARCHUS BURKSI* SP. NOV.

SIXTH CONTRIBUTION TO THE COLEOPTERA FAUNA OF THE PHILIPPINES

By W. SCHULTZE

(Manila, P. I.)

ONE PLATE

The Coleoptera herein described are mainly a few of the many species collected by my Filipino collector on a trip to the main cordillera of Panay Island in May, 1918, and on another trip to Ilocos Norte Province, Luzon, in August, 1918. The latter collection was made in the mountains at the extreme north-western corner of Luzon.

NEW SPECIES OF CURCULIONIDÆ

Genus *PROAPOCYRTUS* novum

Rostrum with a prominent medial groove, extending to the vertex, and a strongly pronounced cross groove before the eyes. Antenna with the first and second funicular joints of equal length, third to seventh also equal in length, together one-fifth longer than the first and second. Prothorax subcylindrical, dorsally somewhat flattened, with an anterior and a posterior submarginal groove. Elytra dorsally flattened, laterally strongly and abruptly declined in an acute angle, apically produced, on the posterior decline with prominent subsutural ridges, and the apical ends of the elytra divergent. Hind femora reaching to about the third fourth of the length of the elytra posteriorly.

Type of the genus, *Proapocyrtus insularis* sp. nov.

This genus is most nearly related to *Apocyrtus* Erichs.,¹ but it is easily recognizable by the oblong oval and dorsally flattened form of the elytra, against the more spherical and inflated form of the above-mentioned genus.

Proapocyrtus insularis sp. nov. Plate I, fig. 1.

Black, with pale green scale spots. Rostrum very irregularly and coarsely, front more finely, sparsely, and scatteredly punctured. The medial groove broad, on the front and vertex fine and narrow. Prothorax strongly coriaceous, with an irregular medial groove. A small spot at the middle laterad and another

¹ Heller, K. M., *This Journal* Sec. D (1912), 7, 301.

larger spot at the lateral margin. Elytra very coarsely and irregularly punctate-striate, the interstices forming raised ridges. The lateral declines of the elytra with deep elongated depressions. Each elytron with eight scale spots, and one bifid spot on the suture at the posterior decline. The former spots are located as follows: Two near the base, one of which at the lateral margin is the largest; four in the middle area, two of which are at the disk, one at the lateral decline, the other at the lateral margin; another spot at the apical third, and another in the apical triangle. Legs finely and scatteredly punctured, the tibiae finely and sparsely setose.

Length, 15 millimeters; width of elytra, 6.5.

PANAY, Capiz Province, mountains near Jamindan (type) (my collector); and two other specimens from PANAY, Antique, Culasi (*R. C. McGregor*).

The spots are somewhat variable in color; in one of the specimens from Culasi they are blue.

Pseudapocyrus multimaculatus sp. nov. Plate I, fig. 2.

Shiny black, with pale green spots. Rostrum densely and irregularly punctured. A prominent medial groove from the base of the rostrum reaching to the vertex. A large scale spot on the front. Prothorax as long as broad, strongly coriaceous. A prominent medial groove, beset with scales, laterad of which a broad irregular scale stripe, another at the lateral margin. Elytra shiny, irregularly punctate-striate, the punctures very coarse. The interstices forming slightly elevated ridges or callosities. Spotted areas depressed. Basal area with a series of six irregular pale green scale spots. At the middle, forming a cross row, a series of four spots and in the apical third a series of five slightly larger spots. A lateral marginal stripe extending from the base to the second third only. In the posterior half a subsutural series of spots, forming a stripe which terminates near the apex. Underside with a spot at the lateral margins of the meso- and metathoracic and the visible part of the abdominal segments. Legs finely and sparsely punctured and rugose and finely setose.

Length, 12 millimeters; width of elytra, 5.5.

LUZON, Ilocos Norte, Mount Palimlim. Type in my collection.

Macrocyrtus ilocanus sp. nov. Plate I, fig. 10, ♀.

Shiny black. Rostrum, at the apex slightly broader than at the base, apically finely and densely punctured, more coarsely and irregularly toward the front. A very well-pronounced medial groove reaching to the front of head and a shallow triangular

depression in the middle area of the rostrum. Prothorax as long as broad at the base. An oblong spot at the posterior margin laterally, and another at each lateral margin; a fine interrupted line of scales along the anterior margin. Elytra oblong oval, one and one-half times as long as broad, finely and regularly punctate-striate. Each elytron with eight irregular pale greenish white scale spots. The spotted area slightly depressed. Two spots at the base, one of which is the largest spot at the discal area and the other at the lateral margin. Two spots at the middle, the outer one reaching almost to the lateral margin. Three spots forming a cross row in the apical third and one spot in the apical triangle. Between the last-mentioned spots a number of scattered scales along the margin. In the male the latter spots approach each other more than in the female. Legs sparsely punctured and finely setose. Tibiæ with a few tubercles on the underside.

Female, length, 17 millimeters; width of elytra, 8. Male, length, 17.5 millimeters; width of elytra, 7.5.

LUZON, Ilocos Norte, Mount Palimlim. Types in my collection.

The female of *Macrocyrtus ilocanus* is similar in form to the female of *M. erosus* Pasc. Both of these species and *M. benquetanus* Schultze have the apical ends of the elytra more or less divergent and differ in this respect from the type of this genus, *M. nigrans* Pasc.

Metapocyrtus (*Artapocyrtus*) *panayensis* sp. nov. Plate I, fig. 4, ♀.

Black, with pale yellowish green spots, elytra almost entirely pink or violet with bare spots. Rostrum densely and irregularly confluent punctured with a medial groove reaching to the vertex and a cross groove at the base. An oblong narrow pale green scale spot reaching the front. Prothorax subglobose, slightly broader than long, coarsely and confluent punctured, with an anterior and posterior submarginal groove. At the middle laterally a roundish pale yellowish green scale spot and another larger spot at the lateral margin confluent with a narrow anterior marginal band. Elytra oblong oval, irregularly punctate-striate; in the female apically slightly produced; covered with violet scales, with the exception of the following bare areas and yellowish markings: Beginning at the base and along the suture a bare area, expanded spotlike at the middle from which an irregular oblique band extends toward each lateral margin. At the lateral margin three squarish bare spots and another at the suture and the apical triangle. The violet of the elytra turns into yellowish green near the margins. In

the male the bare sutural area is more in shape like a + and the oblique bands are reduced to a lateral spot. Underside rugose and finely setose. Legs: Femora with a ring spot apically, sparsely punctured, finely rugose and setose; tibiae coarsely rugose and setose, with a few small tubercles on the underside.

Female, length, 13 millimeters; width of elytra, 5.5. Male, length, 11 millimeters; width of elytra, 4.5.

PANAY, Mount Macosolon. Types in my collection.

This species and *Pachyrrhynchus jugifer* Waterh. were collected together from the same plant.

Metapocyrtus (*Orthocyrtus*) *orbiferoides* sp. nov. Plate I, fig. 7, ♀.

Shiny black, elytra with pink scales and bare spots. Rostrum irregularly scatteredly punctured, less toward the front, with a large, medial, oblong triangular depression terminating in a punctiform impression on the front. Prothorax as long as broad, greatest width before the middle, finely and scatteredly punctured. A narrow pale green scale stripe along the anterior margin, continued along the lateral and posterior margin, and terminating in an oblong spot, laterad of the middle at the posterior margin. Elytra punctate-striate; with pink scales, except the following bare areas: At the basal half a large, squarish spot at the suture and another irregular spot on each elytron, forming an irregular cross band. Beyond the middle a series of five spots, one at the suture, and two on each elytron. The former and latter sutural spots are narrowly confluent along the suture. Another small bare spot at the lateral margin apically and another at the suture. Underside with a pale green spot at the meso- and metathoracic segments laterally. Legs sparsely and scatteredly punctured and finely rugose and setose.

Length, 13.5 millimeters; width of elytra, 6.7.

LUZON, Ilocos Norte, Mount Nagapatan. Type in my collection.

This species resembles very much *Pachyrrhynchus orbifer* Waterh.

Metapocyrtus congestus sp. nov. Plate I, fig. 3.

Shiny black, with large oval blue scale spots. Rostrum densely and confluent punctured, with a pronounced medial depression. A large blue scale spot from the base to the front. The latter finely and scatteredly punctured. Sides of head finely rugose. Prothorax with a fine anterior submarginal and a more pronounced posterior submarginal groove, and finely and sparsely punctured. A large oval scale spot at the middle laterad,

another still larger one at each lateral margin. Elytra finely punctate-striate. Each elytron with nine large blue oval scale spots, which approach each other closely. The spots are arranged in three cross rows; the basal row contains two, the medial three, the postmedial two, one marginal spot is located between the medial and latter row and another spot on the apical triangle. Underside and legs irregularly punctured and finely setose, especially the tibiae.

Length, 11.5 millimeters; width of elytra, 4.5.

LUZON, Benguet, Baguio (O. Schultze). Type in my collection.

This species looks very much like small specimens of *Pachyrhynchus congestus* Pasc. and was collected together with that species from the same plant.

Homalocyrtus pretiosus sp. nov. Plate I, fig. 9, ♀.

Dark brown. Rostrum anteriorly broader than at the base. A very strongly pronounced medial groove reaching to the front beset with golden green scales and a well-pronounced basal cross groove. Apical part densely and finely punctured, the punctuation toward the base becoming coarse and on the vertex scattered and sparse. An oblong scale spot at the sides of head. Prothorax broader than long, a fine anterior submarginal groove, coarsely and densely punctured, especially toward the sides, the punctuation confluent. A longitudinal irregular medial groove-like depression beset with golden green scales and an oblong spot laterad from before the middle to the hind margin. Lateral marginal area also with golden scales, the same continued along the anterior margin, forming a narrow band which is interrupted discally. Elytra of female evenly oval in form, the hind slope evenly rounded; male with an oblong bare protuberance at the suture and posterior decline. The latter nearly rectangular. The elytra coarsely and irregularly but moderately densely punctured, the punctures confluent near the suture, from each puncture a fine hair arises. Each elytron with a series of nine, more or less distinct, longitudinal golden green scale stripes; these are very irregular and interrupted, especially at the middle somewhat laterad where thus two bare cross bands are formed. These bare areas are still larger in the male. Underside finely setose, a lateral marginal spot at the mesothoracic segment, abdominal segments rugose laterally. Legs finely setose, reddish brown, black at the apex of the femora and tibiae, the latter with a number of small tubercles on the underside. Tarsi black and finely setose.

Female, length, 16.5 millimeters (without rostrum) ; width of elytra, 8.5. Male, length, 14.5 millimeters (without rostrum) ; width of elytra, 7.

LUZON, Ilocos Norte, Mount Palimlim. Types in my collection. This species is related to *H. tomidosus* Heller.

Polycatus panayensis sp. nov. Plate I, fig. 8.

Black with very irregular light blue or bluish white iridescent cross bands on the elytra. Rostrum twice as long as broad, with a prominent medial carina which is broader at the apex and terminates between the eyes. Laterad of the carina an oblong dash of light blue scales. Front of head slightly depressed. Prothorax with an oblong smooth and shiny area at the disk, the same surrounded by a series of very coarse punctures. Laterad of this area an indistinctly defined light blue dash and short line on each lateral margin. Very coarse and irregularly scattered punctures are situated laterad of the discal area. Elytra very much inflated, striate-punctate, the punctures larger, as in *P. aurofasciatus* Heller. A number of very irregular cross bands, connected at intervals by short lines along the striae and thus forming an irregular net work. A stripe along the lateral margin. This stripe is bluish white, near the base opalescent blue. Interspaces rugose, finely and scatteredly punctured, and beset with short bristles, especially apically. Underside beset with greenish blue scales. Legs bluish iridescent, sparsely punctured and setose.

Length, 18 millimeters ; width, 8.

PANAY, Capiz Province, mountains near Jamindan. Type in my collection.

This species is larger and much stouter than either *P. aurofasciatus* Heller or *P. eupholoides* Heller.

Calidiopsis lineata sp. nov. Plate I, fig. 5.

Dark brown with very fine creamy white scales, elytra beset with rather long bristles. Head: Antenna, the scape densely beset with fine black bristles, the funicular joints creamy white. Rostrum with a fine longitudinal medial groove and a creamy white stripe extending to between the eyes where the latter becomes bifid. Thorax longer than broad, greatest width before the middle, coarsely and irregularly punctured. A creamy anterior marginal line, a medial line, and another at each lateral margin extending from the anterior to the posterior margin. Elytra striate. Each interstice with a row of granules, from each of the latter arises a bristle. A medial band across the

disk becoming confluent at the seventh interstice with a longitudinal stripe, the latter extending from the anterior margin to the apical triangle. Another stripe at each lateral margin and a sutural stripe extending from the base to the medial band only. An abbreviated stripe at the fifth interstice near the anterior margin and another abbreviated stripe on the third interstice in the apical triangle. Underside and legs closely covered with creamy white scales. The legs beset with fine bristles.

Length, 9.5 millimeters; width, 4.

MINDANAO, Misamis, Kolambugan (*C. S. Banks*). Type in my collection. Cotype No. 18365 in College of Agriculture collection.

A NEW CERAMBYCID

Doliops imitator sp. nov. Plate I, fig. 6.

Black, head with a longitudinal medial groove and a reddish tomentose stripe reaching to the vertex. Antenna, first and second joints black, the following reddish brown, darker at the apex. Prothorax with a prominent groove parallel to the hind margin. A few scattered punctures at the discal area and coarser and irregularly scattered punctures at the lateral margins. A narrow band along the anterior and posterior margin, and the lateral area reddish tomentose. Elytra very finely coriaceous. Basal half with irregularly scattered coarse punctures, confluent near the shoulders. Elytra pinkish gray tomentose with the exception of the following bare areas: A nearly square spot at the shoulder; slightly beyond the middle a combination of three spots, which are confluent at the suture; one on each elytron, forming an irregular cross band, and another spot at the suture directed toward the base. At the posterior third another combination of three smaller confluent spots forming also a cross band, the larger one situated at the suture and continued to the apical triangle. All of the bare spots are surrounded by an interrupted line of creamy white tomentose dots, underside more or less tomentose, a spot at the lateral margin of each abdominal segment. Legs shiny bluish black. Femora with a small spot near the apex, above and below. Tibiæ with a fringe of short black bristles.

Length, 10.5 millimeters; width, 4.5.

LUZON, Ilocos Norte, Mount Nagapatan. Type in my collection.

Specimens of this species and of *Metapocyrtus orbiferoides* sp. nov. were collected with a very large number of specimens

of *Pachyrrhynchus orbifer* Waterh. from the same plant. The general resemblance of *Doliops imitator* to the former species and even greater resemblance to some of the forms of the latter species are truly remarkable. Even the fine lines surrounding the bare spots, so characteristic in *P. orbifer* Waterh., are well pronounced in this mimetic cerambycid.

Concerning the problems of mimicry² and the fundamental reasons for it with reference to Coleoptera as applied to the above species, belonging to different genera of one family or to entirely different and widely separated families, the most essential factor for any consideration at all would be that such mimetic species are found together in the same locality or even on the same plant. In this respect it is worth mentioning the following species which would enter into consideration based on actual observation and data:

Pachyrrhynchus orbifer Waterh., *Metapocyrtus orbiferoides* Schultze, and *Doliops imitator* Schultze. Collected from the same plant, on Mount Nagapatan, Ilocos Norte, Luzon.

Pachyrrhynchus reticulatus Waterh., *Pachyrrhynchus gloriosus* Faust, *Metapocyrtus* (*Orthocyrtus*) *pachyrrhynchoides* Heller, *Metapocyrtus* (*Orthocyrtus*) *bakeri* Heller, and *Doliops pachyrrhynchoides* Heller. Collected together in Paete and on Mount Banahao, Luzon.

Pachyrrhynchus congestus Pasc., *Metapocyrtus congestus* Schultze, and *Alcides schuetzei* Schultze. All from the neighborhood of Baguio, Benguet, Luzon.

Pachyrrhynchus jugifer Waterh. and *Metapocyrtus panayensis* Schultze. From the same locality and the same plant; Mount Macosolon, Capiz, Panay.

It seems premature for the present, aside from the above-mentioned facts, to enter into any reasonable explanation for the above mimetic forms, since much more exact data are necessary on the subject. By the examination of large numbers of birds' stomachs we hope to obtain some more information. This work is being carried on in coöperation with Mr. R. C. McGregor.

RHIPIDOCERIDÆ

NEW CALLIRHIPIS SPECIES

Callirhipis macgregori sp. nov.

Male.—Brownish red. Head densely punctured, eyes relatively large and produced. Antenna red, first joint rather long. Prothorax densely punctured, at the middle, laterally, with a large shallow depression, inside of which is located a fovea, the

² Heller, K. M., *This Journal*, Sec. D (1912), 2, 299.

depression extends to the posterior margin. Another shallow depression at the posterior margin above the scutellum. Elytra coarsely punctate-striate, the punctures large and square, separated by distinct carinae. Legs and underside red, also punctured, the latter as well as the upper side finely but scantily pale yellowish pubescent.

Length, 12.5 millimeters; width, 3; length of antenna, 8.

PANAY, Antique, Culasi (*R. C. McGregor*). Type in my collection.

This species is related to *C. tiaongona* Schultze but is easily distinguished from the latter by the longer antennae and the larger and more-produced eyes.

Callirhipis viracensis sp. nov.

Male.—Dark brown, very finely and closely silver-grayish pubescent, but without the plushlike iridescent appearance of *C. lagunæ* Schultze. Head irregularly punctured, a bare spot at the front. Prothorax closely and confluent punctured. At the disc, laterad, a rather large fovea, and at the middle near the posterior margin two other shallow depressions and another larger depression at the posterior margin laterad. The latter is continued on each elytron. Elytra coarsely and irregularly punctate-striate. Underside very closely and finely punctured and finely pubescent.

Length, 14 millimeters; width, 4; length of antenna, 7.

CATANDUANES, Virac (my collector). Type in my collection.

From *C. helleri* Schultze this species is easily distinguished by the relatively short antenna, the length of which in the latter species is 17 millimeters and in *C. lagunæ* 16 millimeters.

ILLUSTRATIONS

[Drawings by W. Schultze.]

PLATE I

- Fig. 1. *Proapocyrtus insularis* sp. nov. × 2.
2. *Pseudapocyrtus multimaculatus* sp. nov. × 2.
3. *Metapocyrtus congestus* sp. nov. × 2.
4. *Artopocyrtus panayensis* sp. nov. × 2.
5. *Calidiopsis lineata* sp. nov. × 2.
6. *Doliops imitator* sp. nov. × 2.
7. *Orthocyrtus orbiferoides* sp. nov. × 2.
8. *Polycatus panayensis* sp. nov. × 2.
9. *Homalocyrtus pretiosus* sp. nov. × 2.
10. *Macrocyrtus ilocanus* sp. nov. × 2.

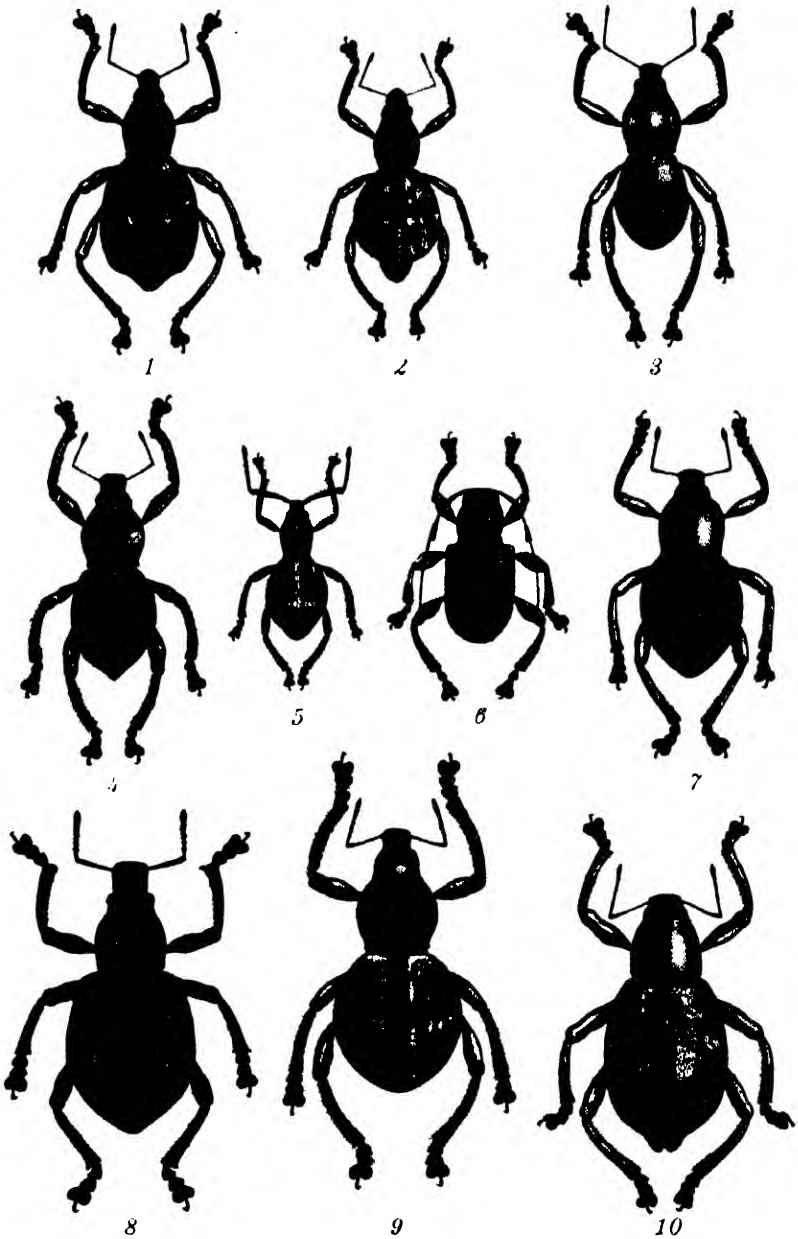


PLATE I. NEW PHILIPPINE COLEOPTERA.

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[New names are printed in clarendon type.]

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